A STUDY OF THE FEASIBILITY OF ELIMINATING THE 2 1/2 TON PAYLOAD TRUCK CLASS

FINAL REPORT

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A STUDY OF THE FEASIBILITY OF ELIMINATING THE 2 1/2 TON PAYLOAD TRUCK CLASS

FINAL REPORT

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The purpose of this study was to determine whether a mix of 5/4- and 5-ton payload trucks, with associated trailers, would be a more cost effective program solution than the proposed Family of Medium Tactical Vehicles (FMTV) 2 1/2- and 5-ton solution. A substitution algorithm based upon individual vehicle missions was developed and four alternative truck and trailer fleets were defined for 260 Army TOEs representing about 72% of the 2 1/2-ton truck fleet. Each alternative had at least the payload capability of the FMTV Baseline Fleet. These results were extrapolated to the entire 2 1/2-ton truck fleet. Sensitivity analyses were conducted. Elimination of the 2 1/2-ton truck from the force was found to be feasible. Further, each alternative had greater weight and cube capability than the Baseline (an assessment of the utility of this added capability was beyond the scope of this study) and slightly improved mobility. Alternative fleets where HMMWVs and CUCVs and associated trailers substituted for LMTVs had somewhat less mobility than those where

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only MTVs substituted for LMTVs. An assessment of the impact of mobility on mission capability was beyond the scope of this analysis. However, each alternative was found to be more costly, require more operating cost, have less strategic deployability, and require about 1,200 more drivers and maintenance personnel. No compelling reason was found for eliminating the 2 1/2-ton truck from the FMTV family.

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EXECUTIVE SUMMARY

1. PURPOSE

The US Army has initiated the Family of Medium Tactical Vehicles (FMTV) program to acquire Light Medium Tactical Vehicles (LMTV) (2 1/1-ton) and Medium Tactical Vehicles (MTV) (5-ton) and associated trailers. This study examines the feasibility of alternative mixes of 5/4-ton and 5-ton trucks with associated trailers that would provide (without the LMTV variant):

- increased capability (with respect to the proposed FMTV program) at comparable cost, and,
- capability comparable to that provided by the proposed FMTV program at less cost.

In addition, the potential manpower and operating cost implications of removing the LMTV variant from the FMTV fleet are analyzed.

2. METHODOLOGY

Figure ES-1 presents an overview of the methodology applied to the analysis.

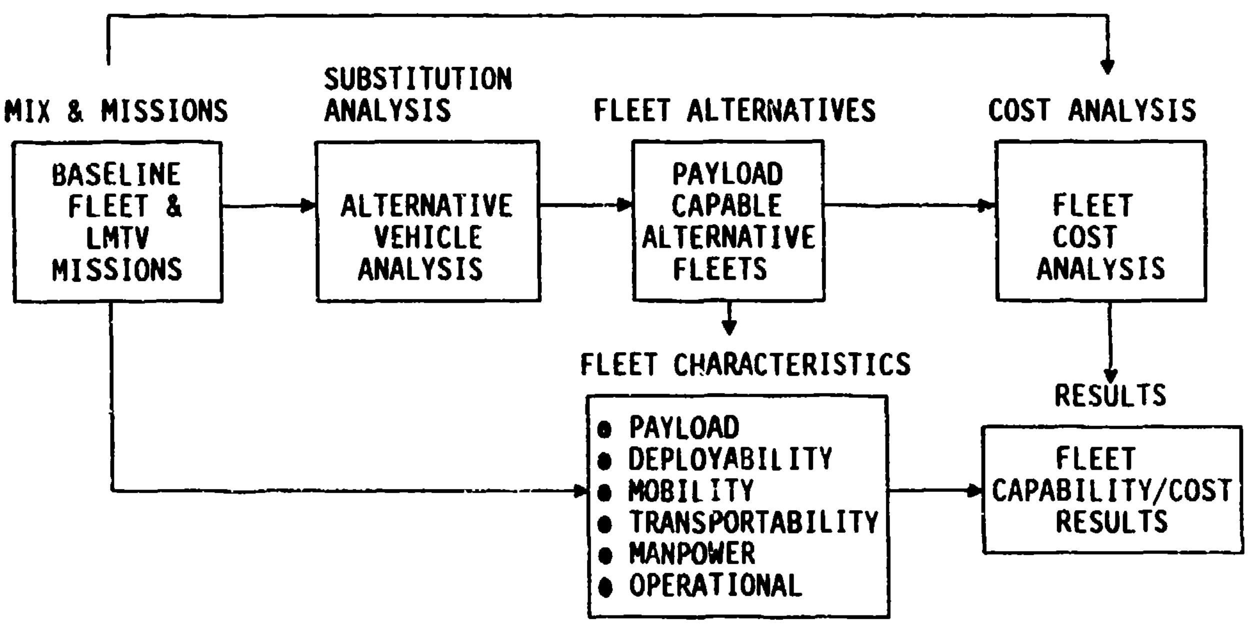

FIGURE ES-1. METHODOLOGY OVERVIEW

The first two steps in the methodology were based upon the 65,098 2 1/2-ton truck requirement of the FY97 Objective Force as defined in the Force

Accounting System (FAS) and modified by the application of the FMTV BOIP. Unit and vehicle missions were defined by current Table of Organization and Equipment (TOE) documentation. Detailed analysis of vehicle requirements within all TOEs was beyond the scope of this study. A subset of 134 SRCs, including 35,995 2 1/2-ton trucks in 260 distinct TOEs, was selected by the study team and approved by the Study Advisory Group (SAG) for detailed analysis. These TOEs included representative samples of all Active Army, National Guard, Army Reserve, and POMCUS organizational structures and all combat, combat support, and combat service support organizations. All TOEs of the four types of active Divisions were analyzed.

Per SAG guidance, the Army's Tactical Wheeled Vehicle Modernization Plan Procurement Strategy objective of 30,467 LMTVs and 67,413 MTVs was defined as the Baseline Force. The results of the analysis of the 134 SRCs was extrapolated to this force to develop six alternative vehicle fleets for comparison with the Baseline Fleet. The first alternative was developed by the Tactical Wheeled Vehicle Requirements Management Office (TWVRMO) at Fort Eustis. In this alternative, all 2 1/2 ton trucks were replaced by 5-ton trucks in keeping with Army policy requiring minimum items of equipment. SAIC developed substitution algorithms leading to three additional alternatives. Alternative 2 substituted 5/4-ton trucks for 2 1/2 ton trucks wherever possible; Alternatives 3 and 4 consolidated loads within and between sections, minimizing the number of 5-ton trucks required in Alternatives 1 and 2, respectively. Two additional alternatives were developed as sensitivities. Alternative 5 assumed the existence of a 5/4-ton trailer in place of the 3/4-ton trailer in Alternative 4. Alternative 6 modified Alternative 4 by assuming no CUCVs in the force.

Following the development of the force alternatives, fleet costs were developed and fleet characteristics were analyzed.

3. OPERATIONAL ANALYSIS

Truck Analysis. Table ES-1 presents the baseline truck fleet and each of the alternatives.

TABLE ES-1. TOTAL TRUCKS BY ALTERNATIVE

TYPE	BASE	ALT 1	ALT 2	ALT 3	ALT 4	ALT 5	ALT 6
LMTV	30467	0	0	0	0	0	0
MTV	67413	97880	96517	97830	96467	96467	96467
HMMWV	0	0	1524	0	1524	1327	2410
CUCV	0	0	886	0	886	771	0
TOTAL TRUCKS	97880	97880	98927	97830	98877	98565	98877
% CHANGE	N/A	0.0	+1.1	-0.1	+1.0	+0.7	+1.0

In Alternative 1, it can be seen that all LMTVs are replaced by MTVs, resulting in the same total number of vehicles. In Alternative 2, LMTVs are replaced by MTVs, and, wherever possible, by HMMWVs or CUCVs. It can be seen that there were limited opportunities for the substitution of 5/4-ton trucks for LMTVs. In all, 95% of the LMTVs were replaced by MTVs. This was because of the LMTVs mission as prime moves for various non-cargo trailers and trailer mounted systems (40%), the configuration of LMTV loads being imcompatable with downsizing (50%), and secondary mission of the LMTV (5%). In Alternatives 3 and 4, a reduction of only 50 MTVs can be seen resulting from the consolidation of loads within or between sections. When the 5/4-ton trailer was assumed in Alternative 5, a savings of 312 5/4-ton trucks resulted. In Alternative 6, the 771 CUCVs in Alternative 4 were converted to HMMWVs, resulting in the same number of 2410 5/4-ton trucks. Thus, in each alternative, the total number of trucks in the fleet varies by 1% or less from the Baseline.

Trailer Analysis. Table ES-2 presents the results of the trailer analysis.

TABLE ES-2. TOTAL TRAILERS BY ALTERNATIVE

TYPE	BASE	ALT 1	ALT 2	ALT 3	ALT 4	ALT 5	ALT 6
3/4-TON	0	0	1786	0	1786	1685	1786
5/4-TON	0	0	0	0	0	413	0
1 1/2-TON	31518	31518	30676	31518	30676	30676	30676
2 1/2-TON LMTV	10910	10910	10859	10910	10859	10859	10859
5-TON MTV	827	827	827	827	827	827	827
TOTAL TRAILERS	43255	43255	44148	43255	44148	44460	44148
% CHANGE	N/A	0.0	+2.1	0.0	+2.1	+2.8	+2.1

It can be seen that there is little variation in the number of trailers between the alternatives and the Baseline. Of special interest is the fact that a requirement was identified for only 413 5/4-ton trailers in Alternative 5. The 413 5/4-ton trailers reduced the requirement for 3/4-ton trailers by 101 to go along with the savings of 312 5/4-ton trucks.

4. COST ANALYSIS

The results of the cost analysis are displayed in Table ES-3. The results include the cost of rebuys to maintain the fleet as vehicles reach their life expectancy.

TABLE ES-3. COMPARISON FOR BASE CASE AND ALTERNATIVES (97,880)
(FY90 CONSTANT $ BILLIONS)

CATEGORY	B L	ALT 1	ALT 2	ALT 3	ALT 4	ALT 5	ALT 6
PRODUCTION	$10.18	$10.82	$10.77	$10.81	$10.76	$10.75	$10.76
FIELDING	1.20	1.31	1.30	1.31	1.30	1.30	1.30
SUS	8.24	8.63	8.63	8.63	8.63	8.63	8.63
TOTAL	19.62	20.76	20.70	20.75	20.69	20.68	20.69
CHANGE	--	5.8%	5.5%	5.8%	5.5%	5.4%	5.5%
RESIDUAL VALUE	$ 5.01	$ 5.45	$ 5.40	$ 5.45	$ 5.40	$ 5.40	$ 5.40
TOTAL LESS RESIDUAL	14.61	15.31	15.30	15.30	15.29	15.28	15.29
CHANGE	__	4.8%	4.7%	4.7%	4.7%	4.6%	4.7%
FIXED COST FOR MTV	$14.39	$14.39	$14.39	$14.39	$14.39	$14.39	$14.39
TOTAL W/O FIXED	5.23	6.37	6.31	6.36	6.30	6.29	6.30
CHANGE	--	21.8%	20.7%	21.6%	20.5%	20.3%	20.5%

It was found that each of the alternatives was approximately 5.4% to 5.8% more costly than the baseline. However,in cost estimating, differences of less than ten percent are not considered significant. Examination of the residual value of fleets, likewise, offered little insight since all fleets are procured at about the same rate and the residual value is very similar in each case. $14.39 billion of the total LCC for the Baseline and any Alternative are attributable to the 67,413 MTVs which are common to each. When the cost impact of this large fixed cost is removed, the alternative fleets vary from 20.3% to 21.8% more expensive than the Baseline. This change, which reflects expected cost increases experienced if the LMTVs were eliminated, is significant and adds meaning to the estimated 5+% increase in fleet costs when the costs of the 67,413 MTVs common to all alternatives are considered. Table ES-4 provides a look at the impact of sustainment costs. This table shows that the annual sustainment cost increase for each of the alternative fleets is about $30M or 4.2% to 4.9% greater than the $669M Baseline costs when the fleets are fully fielded.

TABLE ES-4. SUSTAINMENT COST IMPACTS ON FULLY FIELDED REQUIREMENT (FY90 CONSTANT $ MILLIONS)

	B L	ALT 1	ALT 2	ALT 3	ALT 4	ALT 5	ALT 6
VEHICLE QUANTITIES							
HMMWV	0	0	1,524	0	1,524	1,327	2,410
CUCV	0	0	886	0	886	771	0
LMTV	30,467	0	0	0	0	0	0
MTV	67,413	67,413	67,413	67,413	67,413	67,413	67,413
MTV(LMTV)	0	30,467	29,104	30,417	29,054	29,054	29,054
TOTAL	97,880	97,880	98,927	97,830	98,877	98,565	98,877
TOTAL ANNUAL SUSTAINMENT COSTS (ALL VEHICLES OPERATIONAL)							
COST	$669	$702	$698	$702	$698	$697	$698
%INCREASE		4.9%	4.3%	4.9%	4.3%	4.2%	4.3%

Sensitivities were analyzed including a constrained funding case, increased life expectancy of the HMMWV and CUCV, an increase in annual miles driven for the 5/4-ton truck in the LMTV role, and, increases in the number of drivers for the MTV and decreases for the 5/4-ton truck when performing in the LMTV role. In no case was the sensitivity found to be significant.

A logistics assessment was conducted to include special tools, training, publications, National Stock Numbers, retail parts, wholesale parts and facilities. It was found that there is a net logistics cost of approximately $187M to $200M resulting from the elimination of the LMTV fleet. This increase stems primarily from the costs associated with the retail and wholesale parts inventory. These costs were included in the LCC results presented earlier.

5. FLEET CHARACTERISTICS

An analysis of the Baseline and Alternative fleet characteristics, including payload capacity, strategic deployability, mobility, transportability, and manpower requirements was conducted. Results are presented in Table ES-5 in terms of the percent of change from the Baseline Fleet. While for nearly each characteristic the Alternative fleets demonstrate increases in the respective measures, the reader is cautioned to remember that these increases are not all advantageous. Additionally, the characteristics are not necessarily of equal value. As indicated in the discussion below, the utility of payload and mobility enhancement was not assessed.

TABLE ES-5. ADVANTAGES AND DISADVANTAGES OF FLEET ALTERNATIVES

ALTERNATIVE	WEIGHT	CUBE	SORTIES* (ABN DIV)	MOBILITY	TRANSPORT-ABILITY	MAN-POWER*
BASELINE	-	-	-	-	-	-
1. TWVRMO (HVY)	27.5	5.4	26.4	@	-	3.3
2. LIGHT	24.8	5.0	20.8	@	4.8	3.7
3. HEAVY-CONSO	27.4	5.3	23.2	@	-	3.3
4. LIGHT-CONSO	24.7	4.9	17.6	@	4.8	3.7

* INDICATES FACTORS IN WHICH INCREASES ARE UNFAVORABLE
@ SPECIFIC MEASURES OF MOBILITY WERE NOT CALCULATED

Weight and cube capability of each of the alternatives is significantly greater than the Baseline Fleet. It should be pointed out that the Baseline Fleet is judged to be capable of performing its load hauling mission. An assessment of the utility of the added capability was beyond the scope of this study.

All alternatives require more sorties for strategic deployability than the Baseline Fleet.

Alternatives 1 and 3, where only the MTV substitutes for the LMTV, have enhanced mobility compared with the Baseline Fleet. Since 5/4-ton trucks have reduced mobility compared to the LMTV, the mobility of Alternatives 2 and 4, which contain less than 3% 5/4-ton trucks, was slightly less than Alternatives 1 and 3 but still improved when compared with the Baseline Fleet is questionable. An assessment of the utility of this enhanced mobility was beyond the scope of the study.

In that 5/4-ton trucks can be lifted by UH-60 helicopters while the LMTV can not, Alternatives 2 and 4 have marginally improved transportability when compared with the Baseline Fleet.

Finally, each Alternative requires about 1200 more personnel in the form of drivers and maintenance personnel than the Baseline Fleet.

6. CONCLUSIONS

The analysis has led to the following conclusions.

- o It is feasible to eliminate the LMTV variant from the FMTV fleet by substituting 5/4-ton and MTV trucks and associated trailers.

- o Because the LMTV mission and capability are well matched the preponderance of substitutions required an MTV; there were few opportunities to substitute smaller, less expensive vehicles. Thus, within the scope of the analysis, no alternatives were found which are less costly than the Baseline Fleet with equal capability.

- Several fleet alternatives exist with life cycle costs about 5.5% greater than the Baseline Fleet. These fleet alternatives have greater weight and cube capability (an assessment of the utility of this added payload capability was beyond the scope of this analysis) and somewhat enhanced mobility when compared with the Baseline Fleet.

- Each of the feasible alternatives identified has shortcomings in the important areas of strategic deployability and personnel requirements.

- Each alternative fleet, when fully fielded, will increase sustainment costs about $30M per year when compared with the Baseline Fleet.

- Based on the factors considered in this analysis, no compelling rationale exists for the elimination of the LMTV variant from the FMTV family.

7. RECOMMENDATIONS

- The 2 1/2-ton truck should be retained in the Army force structure.

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ABSTRACT

The purpose of this study was to determine whether a mix of 5/4- and 5-ton payload trucks, with associated trailers, would be a more cost effective program solution than the proposed Family of Medium Tactical Vehicles (FMTV) 2 1/2- and 5-ton solution. A substitution algorithm based upon individual vehicle missions was developed and four alternative truck and trailer fleets were defined for 260 Army TOEs representing about 72% of the 2 1/2-ton truck fleet Each alternative had at least the payload capability of the FMTV Baseline Fleet. These results were extrapolated to the entire 2 1/2-ton truck fleet. Sensitivity analyses were conducted. Elimination of the 2 1/2-ton truck from the force was found to be feasible. Further, each alternative had greater weight and cube capability than the Baselinc (an assessment of the utility of this added capability was beyond the scope of this study) and slightly improved mobility. Alternative fleets where HMMWVs and CUCVs and associated trailers substituted for LMTVs had somewhat less mobility than those where only MTVs substituted for LMTVs. An assessment of the impact of mobility on mission capability was beyond the scope of this analysis. However, each alternative was found to be more costly, require more operating cost, have less strategic deployability, and require about 1200 more drivers and maintenance personnel. No compelling reason was found for eliminating the 2 1/2-ton truck from the FMTV family.

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SECTION 1
INTRODUCTION

1.1 BACKGROUND

The US Army has initiated the Family of Medium Tactical Vehicles (FMTV) program to acquire vehicle variants with 2 1/2- and 5-ton payload capacities, together with associated trailers. As a result of the OSD Conventional Systems Committee review of the FMTV program on March 31, 1988, approval was granted for the Army to proceed with the building and testing of prototype vehicles. However, the Army was requested to conduct a study to answer questions which had been raised as to whether this program is the most cost effective mix of vehicles for providing the required movement capability. Specifically, there is a need to determine whether a mix of 5/4- and 5-ton payload trucks with associated trailers is a more cost effective program than the proposed FMTV mix.

1.2 PURPOSE

This study examines the feasibility of alternative mixes of 5/4-ton and 5-ton trucks with associated trailers that will provide (without a 2 1/2-ton variant):

- increased capability (with respect to the proposed FMTV Program) at comparable cost, and,
- capability comparable to that provided by the proposed FMTV Program at less cost.

In addition, the potential manpower and operating cost implications of removing the 2 1/2-ton truck from the FMTV fleet are analyzed. (Statement of Work at Annex A.)

1.3 SCOPE

The study is based on the 2 1/2-ton truck requirements of the current Army Master Force as defined in the Force Accounting System and Total Army Analysis and modified by the application of the FMTV Basis of Issue Plan (BOIP). Alternative vehicle mixes are based on 2 1/2-ton truck procurement objectives as reflected in the Office, Deputy Chief of Staff, Operations (ODCSOPS) Modernization Plan, modified to include trailers and replacement vehicles.[1]

Unit and vehicle missions are based upon Table of Organization and Equipment (TOE) documentation.

Alternative vehicle mixes designed to meet unit requirements without a 2 1/2-ton truck variant consist only of those type 5/4-ton vehicles currently in the Army inventory, the proposed 5-ton FMTV vehicle, and, appropriate trailers associated with each of these vehicles.

In estimating alternative costs, Modified Table of Organization and Equipment (MTOE) and Tables of Distribution and Allowances (TDA) requirements are added to TOE and BOIP requirements.

Results are presented in terms of alternative mixes of trucks and trailers, mission capabilities associated with each alternative, and, personnel and costs associated with each alternative.

[1] This study refers in several places to the ODCSOPS Modernization Plan which carries a requirement of 58,258 LMTV 2 1/2-ton trucks and 71,660 MTV 5-ton trucks. It also refers to the ODCSOPS Modernization Plan procurement objectives which include 30,467 LMTVs and and 67,413 MTVs. Per Study Advisory Group guidance, the procurement objective numbers were used as the Baseline and as the basis for developing alternative fleets.

1.4 LIMITATIONS

The study does not develop alternative vehicle sets for every Army TOE unit. All TOEs have been reviewed for the feasibility of eliminating 2 1/2-ton FMTV vehicles, but, because of time and fiscal constraints, alternative vehicle sets have been developed based on those TOEs which include the highest density of 2 1/2-ton vehicles. Separate analyses have been conducted for those low density units with unique 2 1/2-ton truck missions.

With the exception of mission unique 2 1/2-ton truck requirements which will be considered in determining alternative vehicle mixes, the study considers MTOE and TDA vehicle requirements only insofar as the number of these types of vehicles impact fleet quantities and costs.

1.5 ASSUMPTIONS

The number and type of TOE units depicted in the current Army Master Force accurately represent requirements.

Vehicle missions in Army units are accurately reflected in TOE documents.

The Army Master Force as modified by the FMTV BOIP accurately represents 2 1/2-ton vehicle requirements in TOE units.

For the purpose of estimating alternative costs, the ratio of vehicles (5/4-ton, 5-ton, and trailers) substituted for 2 1/2-ton trucks during the analysis of high density and unique mission units can be extrapolated to represent vehicle requirements in MTOE/TDA units and TOE units with low densities of 2 1/2-ton trucks.

The characteristics and capabilities of the 2 1/2-ton and 5-ton FMTV vehicles and associated trailers will be as specified in current requirements documents.

1.6 ORGANIZATION OF THE REPORT

Section 2 of this report presents the methodology applied to the development of alternative fleets with mixes of 5/4- and 5-ton trucks with associated trailers as well as the methodology applied to the costing of those alternative fleets. Section 3 presents the alternative fleets and the costs of those fleets. Fleet characteristics, including payload capacity, strategic deployability, manpower requirements, mobility characteristics, and transportability are analyzed in Section 4. Section 5 analyzes the cost sensitivity of changing various fleet characteristics and presents a logistics assessment. Section 6 presents an analysis summary, and, finally, Section 7 presents conclusions and recommendations.

SECTION 2
METHODOLOGY OVERVIEW

Two major analyses were conducted to accomplish the objectives of this study. An operational analysis was conducted to identify 2 1/2-ton truck requirements and missions; to develop an appropriate substitution methodology; to develop alternative vehicle fleets; and to evaluate the capabilities and characteristics of the alternative fleets. A cost analysis was conducted to develop an appropriate cost methodology and to identify the costs associated with the Baseline fleet and each alternative fleet. Figure 2-1 provides a graphical overview of the study methodology. Sections 2.1 and 2.2 provide overviews of the operational and cost analyses methodologies, respectively.

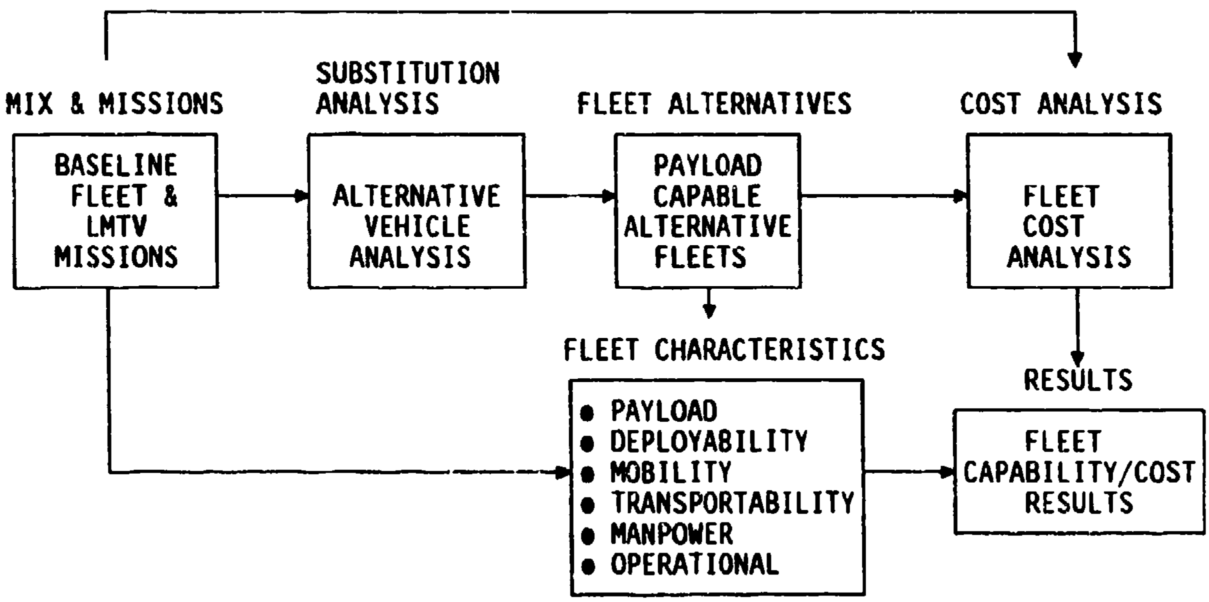

FIGURE 2-1. METHODOLOGY OVERVIEW

2.1 OPERATIONAL ANALYSIS

The operational analysis required the accomplishment of the four primary tasks highlighted in Figure 2-2. An overview of each of these tasks is provided in this paragraph. Detailed explanations of individual task methodologies are provided in Annex B as indicated in the respective overviews.

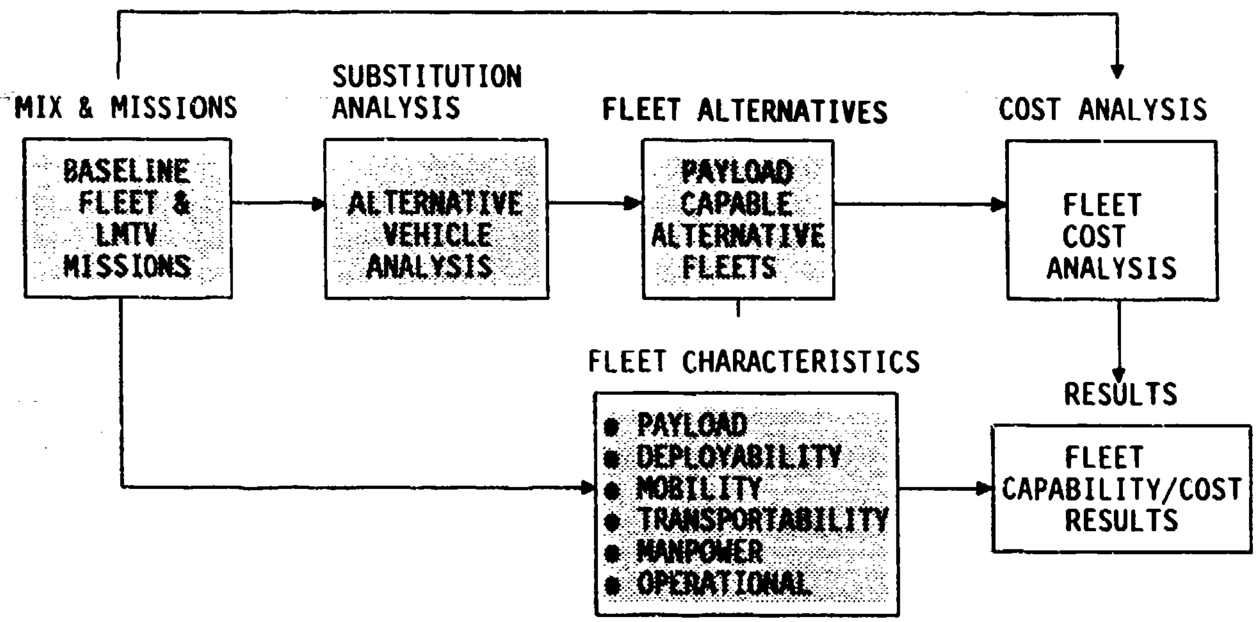

FIGURE 2-2. OPERATIONAL ANALYSIS TASKS

2.1.1 Identification of Vehicle Requirements and Missions.

The first two tasks of the operational analysis were based upon the 2 1/2-ton truck requirements of the FY97 Objective Force as defined in the Force Accounting System (FAS) and modified by the application of the FMTV BOIP[1]. A 2 1/2-ton truck Initial Issue Quantity (IIQ) + POMCUS requirement of 65,098

[1] Tasks 3 and 4, the development of alternative fleets and the evaluation of fleet capabilities, were based upon the Tactical Wheeled Vehicle Modernization Plan Procurement Strategy objectives as explained in Sections 2.1.3 and 3.1.

vehicles was identified in August 1988 data extracted from the Logistics Structure and Accounting System (LOGSACS) by the Force Development Support Agency (FDSA).

Unit and vehicle missions were defined by current TOE documentation provided by the Tactical Wheeled Vehicle Requirements Management Office (TWVRMO) at Fort Eustis, Virginia.

The process of identifying aggregate vehicle requirements and missions is described in detail in Appendix I of Annex B.

2.1.2 Substitution Analysis.

Substitution analysis was accomplished in three phases: the selection of a set of organizations by Standard Reference Code (SRC) on which to conduct detailed analysis of vehicle requirements; the development of a substitution methodology; and the application of the substitution methodology to the organizations identified for detailed analysis so that alternative vehicle sets could be developed for each organization. A detailed description of the substitution analysis is provided in Appendix II of Annex B.

2.1.2.1 SRC Subset Selection. Requirements for 2 1/2-ton trucks were identified in August 1988 LOGSACS data in over 500 organizations, each with a distinct SRC. Detailed analysis of vehicle requirements within each of these organizations was beyond the scope of resources available for this study. A subset of 134 SRCs, which included 35,995 2 1/2-ton vehicles in 260 distinct TOEs, was therefore selected by the study team and approved by the Study Advisory Group (SAG) for detailed analysis. This set of SRCs was selected so that representative samples of vehicles could be examined in detail across all Active Army, National Guard, Army Reserve, and POMCUS organizational structures and across all combat, combat support, and combat service support organizations. All TOEs of the four types of Active Divisions were analyzed. Figure 2-3 indicates the percent coverage of key areas provided by the set of 134 SRCs.

LMTV TOTAL (% VEHICLES):	72
VEHICLE TYPE (% VEHICLES):	
CARGO	71
VAN	82
COMPONENT (% VEHICLES):	
ACTIVE	67
GUARD	74
RESERVE	65
POMCUS	85
BRANCH (% BRANCHES):	82
DIVISION (% TOEs):	
AIRBORNE	100
AIR ASSAULT	100
LIGHT	100
HEAVY	100

FIGURE 2-3. SRC SUBSET COVERAGE

SRCs for 82% of the 33 branches were included in the subset. Thus, only 6 of the 33 branches did not provide any SRCs to the subset. These six branches possessed a total of only 1470 vehicles, of which 1302 were in TDA organizations. For the eight branches (Field Artillery, Infantry, Armour, Engineer, Maintenance, Combat Service Support, Aviation, and Signal) which contain over 75% of the LMTV cargo vehicles, the subset included betweem 50% and 97% of the vehicles in each branch.

2.1.2.2 Substitution Methodology. Development of a substitution methodology included three subtasks: development of vehicle capability measures of effectiveness; identification of feasible sets of vehicles which were capable of performing the missions of the 2 1/2-ton trucks which were to be replaced; and, development of the actual process through which the mission of each 2 1/2-ton vehicle in each SRC selected for detailed analysis would be examined and feasible alternative sets of vehicles identified to accomplish that mission.

Required vehicle capabilities, and hence relevant capability measures of effectiveness, are mission specific. While air deployability, cross-country mobility, or helicopter transportability may be required for a particular vehicle to accomplish a specific mission, all are not required of every 2 1/2-ton vehicle in the Army fleet. However, every vehicle in the fleet with a cargo hauling mission is required to possess sufficient payload capacity in terms of weight and cube to accomplish the assigned mission. Thus, for both individual vehicles and the fleet of vehicles the term "payload capable" was defined to mean that sufficient payload capability existed to carry all loads required as a part of either the vehicle or the units primary or secondary missions. Other capabilities such as deployability, mobility, and transportability were identified as characteristics of the fleet of vehicles to be addressed separately in Section 4.

Study objectives specifically identified the set of alternative vehicles which could be considered as replacements for the LMTV as the current set of 5/4-ton trucks, the 5-ton MTV, and associated trailers. Capabilities and characteristics of these vehicles were identified for use in matching vehicles to specific mission requirements in an analysis at the individual vehicle level.

A subjective vehicle substitution algorithm was developed which required the identification of the mission load for each LMTV in an organization, the identification of a set or sets of alternative vehicles which could perform the load carrying mission, an identification of other operational requirements for the LMTV in question, and the selection of one or more sets of alternative vehicles based upon specified decision criteria.

The substitution methodology developed in this subtask was approved by the SAG at a formal briefing on 6 December 1988.

2.1.2.3 Methodology Application. Application of the approved substitution methodology to the 134 SRCs selected for detailed analysis produced several alternative sets of vehicles for each of the 260 TOEs. In addition to the baseline vehicle set, in which all 2 1/2-ton trucks were either the LMTV cargo truck or the LMTV van, four alternative sets were developed, all without 2 1/2-ton trucks. These alternative sets of vehicles were the basis upon which the alternative fleets were developed as described in paragraph 2.1.3 below.

Alternative Set 1 is referred to as the TWVRMO alternative or the HEAVY alternative because in this vehicle set, developed by TWVRMO, all LMTVs were replaced by the 5-ton MTV. In Alternative Set 2, the LIGHT alternative, LMTV cargo trucks were replaced, where feasible, by 5/4-ton HMMWV or CUCV trucks and associated trailers. When such a substitution was not feasible, the LMTVs were replaced by MTVs. In Alternative Set 3, the HEAVY-CONSOLIDATED alternative, and Alternative Set 4, the LIGHT-CONSOLIDATED alternative, the added cargo capacity of MTV cargo trucks substituted for LMTV cargo trucks in Alternatives 1 and 2 was utilized, where feasible, to reduce the total number of trucks in an organization by consolidating loads within and between sections on the larger trucks.

2.1.3 Development of Alternative Fleets.

Aggregation of the alternative vehicle sets developed for each individual TOE analyzed in the application of the substitution methodology to the 134 SRCs produced four alternative vehicle fleets (TWVRMO or HEAVY, LIGHT, HEAVY-CONSOLIDATED, and LIGHT-CONSOLIDATED) for only those vehicles found in the 260 TOEs analyzed. These results, when weighted by the number of units organized under each TOE across the Army, provided a representative sample of vehicle requirements by alternative across components (Active, Guard, Reserve, and POMCUS) and functional areas (combat, combat support, and combat service support). Conversion factors describing the replacement of LMTVs by various sets of vehicles were then applied to the Tactical Wheeled Vehicle Modernization Plan Procurement Strategy Objective of 30,467 LMTVs to project total Army procurement objectives by vehicle type for each of the alternative fleets considered. Details of this process are described in Appendix III of Annex B. Results are summarized in Section 3.

2.1.4 Evaluation of Fleet Capabilities.

Fleet capabilities were evaluated for the baseline fleet and each alternative fleet in six areas: payload capacity; strategic deployability; mobility; transportability; manpower requirements; and operational impact. A thorough understanding of baseline and alternative fleet capabilities in each of these areas is essential in determining the desirability of alternative fleets as compared to the baseline fleet. Results of fleet capabilities evaluations are presented in Section 4 of this report.

2.2 COST ANALYSIS

The objective of the cost analysis is to determine the cost implications of eliminating the proposed LMTV tactical truck from the proposed FMTV program. This analysis includes a Life Cycle Cost (LCC) assessment (Section 3.2) and an assessment of cost sensitivities including a separate evaluation of the logistics impact of the elimination of the LMTV from the FMTV program (Section 5). Figure 2-4 highlights the cost analysis tasks and presents an overview of the integration of cost and fleet analyses.

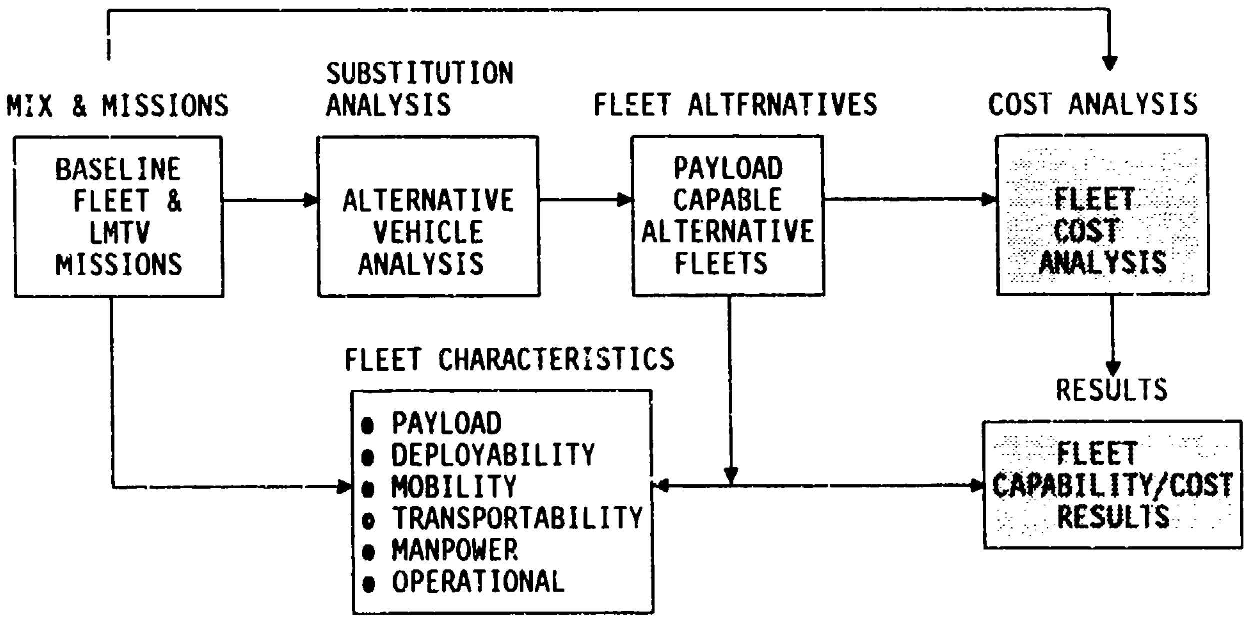

FIGURE 2-4. COST ANALYSIS TASKS

LCC analysis techniques were applied to the base line and alternative fleets developed as a result of the substitution methodology described in Section 2.1.2. Alternative fleets were designed to meet the Army's truck requirements as stated in the US Army Truck Modernization Plan procurement objective. These alternative fleets were compared to the Baseline fleet which contains both the planned FMTV (LMTV and MTV) trucks. A detailed discussion of the cost analysis process and model is included in Annex C, Cost Analysis Details. Cost analysis results are presented in Section 3.2, Cost Analysis Results. Section 5.0, Cost Sensitivities, presents the summary sensitivity analyses and Logistics Assessment.

The approach to the cost analysis task followed a six step process. This process is presented in Figure 2-5.

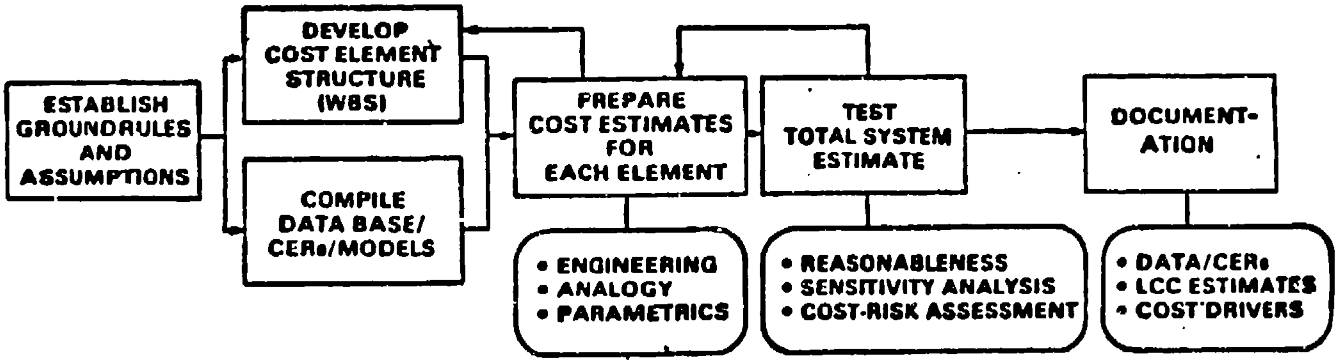

FIGURE 2-5. COST ANALYSIS METHODOLOGY

Ground rules and assumptions were established to insure consistent treatment of alternatives and comparability of results. These ground rules identified the current TWV Modernization Plan as the basis for costs including vehicle life, annual miles, and personnel assignments. Costs were developed in accordance with Army cost analysis instruction, DCA-P-92(R), Instructions for

Reformatting the BCE/ICE. The foundation of the cost analysis rests upon several key assumptions. The following is a listing of those ground rules and assumptions.

Development costs are considered sunk for the FMTV program.

The Unit Procurement Cost (UPC) is a cost used to capture all production related costs under cost element 2.0, as defined by DCA-P-92. UPC's were collected from TACOM (AMSTA-VCW) for each truck in a family, such as the ten trucks comprising the five ton MTV vehicle class. An analysis was performed to develop weighted UPC's based on TACOM's data and the quantities associated with each fleet. The weighted unit cost reflects the actual mix of vehicle variants in each fleet. In addition, costs for applicable kits and federal excise tax on specific vehicles were included in the development of the weighted UPC.

To provide a common basis for cost comparison, all cost data has been normalized to FY90 constant year dollars.

UPCs are multiplied by the quantity per year to generate production costs. No learning curve (cost quantity price break) is considered.

Quantities in the Baseline vehicle fleet are shown as either active, reserve or POMCUS vehicles.

Production costs include vehicle rebuys. That is, vehicles produced in previous years which have operated for their full life are replaced at the end of their life.

Planned production of vehicles begins in FY91. This is to maintain consistency with the truck modernization plan.

A residual value calculated as the ratio of the life divided by the years operated is applied to the cumulative production cost. This figure reflects, in dollars, the value of remaining life available for each vehicle by FY2020.

Values for vehicle life are based upon data received from Tank and Automotive Command (TACOM) Fleet Planning Office. These values are the following:

MTV	22 years
LMTV	20 years
HMMWV	14 years
CUCV	7 years
All Trailers	30 years

The worldwide average fielding cost for each vehicle was provided by TACOM and used as a one time per unit cost in the year fielding occurs. Fielding occurs one year after production.

No Military Construction Appropriation (MCA) was estimated in this analysis.

Operating costs will begin in FY91, which corresponds to the Initial Operational Capability (IOC) in the FMTV program. The operating phase of this analysis will end in the last procurement fiscal year, 2020.

Direct operating costs (excluding crew) on a per vehicle basis are calculated based upon three factors provided by the Fleet Planning Office at TACOM. These factors represent sustainment cost data collected under the Sample Data Collection (SDC) program by Pico Co. for the Army. SDC data used in this study is exactly that data used by TACOM's Fleet Planning Office and the United States Army Cost and Economic Analysis Center (USACEAC) to develop sustainment cost estimating equations for the truck modernization plan. The formula and data are presented in Section 2.2.3. The factors are discussed below.

- Fixed annual costs are those costs which will not vary with vehicle age or annual mileage. These costs include scheduled maintenance, war reserve OMA/ASF repair parts, war reserve procurement spares, maintenance related transportation costs, modification kits, and "Other Sustainment".

- Variable costs include costs for POL (petroleum, oil, and lubricants) and are a function of annual miles driven.

- The annual cost of unscheduled maintenance (man hours and parts) data has been collected to be modelled as a linear function of both vehicle age and annual miles driven per year.

Active vehicles are estimated at 100% of the annual unit sustainment cost. The percentage used for Reserve vehicles is determined based upon actual historical mileage per vehicle collected through Sample Data Collection (SDC). The percentage used for all Reserve vehicles is 70% of the Active sustainment cost. POMCUS vehicles are costed at 10% of the Active sustainment cost.

The number of maintenance personnel associated with each fleet, discussed in Section 4.5, are derived from factors for the number of maintenance men per truck per year times the quantity of active, reserve and POMCUS vehicles.

Miles per year reflects each vehicle's actual mileage as provided by TACOM's Fleet Planning Office and captured by SDC efforts. The annual miles driven are determined by the vehicle role not by the vehicle type, i.e., all vehicles performing the LMTV mission utilize the LMTV annual mileage.

Costs for the DCA-P-92 sustainment cost element 5.081 (Crew Pay and Allowance) are developed on a per vehicle basis using a crew cost times the number of assigned drivers.

Costs associated with DCA-P-92 cost element 5.082 (Maintenance Pay and Allowance) are captured in the formula for direct operating cost.

The value used for the number of assigned drivers for each vehicle is based on the particular mission/role of a vehicle and not vehicle type. In other words, MTV vehicles acting as replacement vehicles for the LMTV reflects the LMTV number of assigned drivers. Listed below are the values used in this analysis.

BASELINE FLEET		ALTERNATIVE FLEET	
MTV	.25	MTV (5-ton role)	.25
LMTV	.10	MTV (2 1/2-ton role)	.10
HMMWV	.00	HMMWV (2 1/2-ton role)	.10
CUCV	.00	CUCV (2 1/2-ton role)	.10

The Army Cost Analysis guidance DCA-P-92(R), Instructions for Reformatting the BCE/ICE, was used to develop the cost element structure. Data were collected to complete the cost analysis and develop cost estimating relationships (CER). Production and fielding cost data were obtained through TACOM's (AMSTA-VCU) cost analysis division. Sustainment cost data were obtained from TACOM's Fleet Planning Office. All data were reviewed with the study cost analysis proponents. See Appendix I to Annex C for details of cost guidance from each meeting with study proponents. These proponents included US Army Cost and Economic Analysis Center (USACEAC), TACOM's Cost Analysis Division, Tactical Wheeled Vehicle Procurement Executive Office (PEO), and the SAG. All sustainment cost data agrees with that used for the tactical wheeled vehicle modernization plan. The generic vehicle cost used for production estimates represents the weighted average cost for the vehicle mix in the alternative fleets. The cost data are presented in Table 2-1.

An automated cost analysis model was developed to prepare cost estimates for each alternatives. The model consists of two Symphony spreadsheets and is described in detail in Annex C. The model allowed the calculation of costs by vehicle and fiscal year. In addition the model uses an equation to calculate the direct operation cost of vehicles such that they are more expensive as they age. The key cost drivers in the model are unit cost (represented by the weighted average Unit Procurement Cost), vehicle life, and annual miles driven. The model also allowed the assessment of alternatives constrained by funding and/or time.

TABLE 2-1. TRUCK STUDY COST DATA
(FY90 CONSTANT $ THOUSANDS)

VEHICLE TYPE	LIFE	MILES	UPC	UNIT FIELDING	MID-LIFE SUSTAINMENT
LMTV (GENERIC)	20	2512	$ 61.4	$7.5	$4.5
CARGO			$ 59.4		
VAN			$ 84.9		
MTV (GENERIC)	22	3054	$ 86.3	$10.4	$7.9
MTV(LMTV)	22	2512	$ 86.3	$10.4	$5.6
MTV (Alternatives)			$ 83.7		
CARGO			$ 72.9		
CARGO LWB			$ 75.9		
CARGO W/MHE			$ 98.1		
CARGO LWB W/MHE			$100.9		
VAN			$132.4		
DUMP			$ 79.2		
WRECKER			$182.2		
POL (1500 GAL)			$104.4		
TRACTOR			$ 72.3		
AMBULANCE			$205.2		
HMMWV	14	2512	$ 24.6	$2.7	$1.6
CUCV	7	2512	$ 17.5	$2.3	$1.2
TRAILERS					
3/4-TON	30	-	$ 2.5	$0.5	$2.6
1 1/2-TON	30	-	$ 4.7	$0.9	$1.3
2 1/2-TON	30	-	$ 15.0	$1.7	$1.3
5-TON	30	-	$ 18.0	$2.4	$2.5
NEW 5/4	30	-	$ 6.1	$0.9	$1.2

Table 2-2 presents the sustainment cost data used in the analysis. The CER or mathematical expression for the annual sustainment cost is based on the following formula:

ANNUAL SUSTAINMENT COST= (INTERCEPT +SLOPE*AGE)*(ANNUAL MILES) + FIXED ANNUAL COST + (CREW P&A *ASSIGNED DRIVER)

TABLE 2-2. TRUCK STUDY SUSTAINMENT DATA
(CONSTANT FY90 $ THOUSANDS)

	TRANS	SCHD MAINT	MOD KIT	OTHER COSTS	TOTAL CONSTANT
HMMWV	0.0249	0.1243	0.1212	0.0000	0.27
CUCV	0.0249	0.2020	0.0684	0.0000	0.29
LMTV	0.0725	0.2310	0.2258	0.0352	0.56
MTV	0.1274	0.2258	0.3098	0.0445	0.70
MTV(LMTV)	0.1274	0.2258	0.3098	0.0445	0.70
TRAILER	0.00	0.00	0.00	0.0000	2.40
TRAILER	0.00	0.00	0.00	0.0000	1.02
LMTV TRLR	0.00	0.00	0.00	0.0000	1.06
MTV TRLR	0.00	0.00	0.00	0.0000	1.90
TRAILER	0.00	0.00	0.00	0.0000	0.93

	SLOPE FACTORS UNSCHED MAINT($)	DEPOT MAINT AVG $/YR	DEPOT MAINT. SLOPE($/MI/YR)	INTERCEPT VALUES UNSCHD MAINT ($/MI)
HMMWV	0.000024	0.2103	0.000007	0.000128
CUCV	0.000016	0.1948	0.000009	0.000117
LMTV	0.000079	0.4735	0.000019	0.000322
MTV	0.000097	0.6713	0.000020	0.000341
MTV(LMTV)	0.000097	0.6713	0.000020	0.000341

	POL ($/MI)	TTL ACTIVE ANNUAL MILES	TTL RESERVE % OF MILES	TTL SUST % FOR POMCUS	TTL SLOPE ($/MI/YR)
HMMWV	0.0001	2512	0.70	0.10	0.000032
CUCV	0.0001	2512	0.70	0.10	0.000025
LMTV	0.0001	2512	0.70	0.10	0.000098
MTV	0.0002	3054	0.70	0.10	0.000117
MTV(LMTV)	0.0002	2512	0.70	0.10	0.000117
TRAILER		4149	0.70	0.10	0.000006
TRAILER		2512	0.70	0.10	0.000008
LMTV TRLR		2512	0.70	0.10	0.000007
MTV TRLR		3054	0.70	0.10	0.000014
TRAILER		4149	0.70	0.10	0.000009

	TTL INTERCEPT ($/MI)	CRT AGE	CURRENT COST ($K/YR)	CURRENT COST ($K/MI)
HMMWV	0.000213	1.37	0.99	0.0004
CUCV	0.000180	3.90	0.99	0.0004
LMTV	0.000470	0.00	1.75	0.0007
MTV	0.000550	0.00	2.39	0.0008
MTV(LMTV)	0.000550	0.00	2.09	0.0008
TRAILER	0.000000			
TRAILER	0.000000			
LMTV TRLR	0.000000			
MTV TRLR	0.000000			
TRAILER	0.000000			

The final step in the process included the testing of the model before cost estimates were developed. This testing included an assessment of the logic and numeric output. Once analytic credibility of the model was established, initial cost estimates were developed. As an additional check, emerging results were presented to the TACOM PEO and Cost Analysis Division for review.

Sensitivity analyses were run to assess cost drivers and the impact of key assumptions. These sensitivities are presented in Section 5.5 of this report.

All cost analysis efforts have been documented to provide a complete audit trail. This documentation is provided in Annex C for detailed analysis.

The following section presents the alternative fleets and costs for each fleet.

SECTION 3
ALTERNATIVE FLEET RESULTS

This section presents study results. Detailed explanations of the analyses underlying these results may be found in ANNEX B, Operational Analysis Details, and ANNEX C, Cost Analysis Details.

Alternative mixes of 5/4-ton and 5-ton cargo trucks, with associated trailers, do exist which are capable of performing the cargo hauling missions currently assigned to the 2 1/2-ton class of trucks. Four such alternatives, as well as the baseline vehicle fleet and several special interest alternatives, are described in Section 3.1. Cost estimates for the baseline fleet and each of the alternatives, to include special interest alternatives, are presented in Section 3.2. Cost sensitivities are examined in Section 5.

3.1 BASELINE AND ALTERNATIVE FLEETS

The FY97 Objective Force as defined in the FAS and modified by the application of the FMTV BIOP documented an IIQ + POMCUS requirement for 65,098 trucks in the 2 1/2-ton (LMTV) class and an additional 62,348 trucks in the 5-ton (MTV) class. Because the results of the recent effort by the Army to develop and implement a Tactical Wheeled Vehicle Modernization Plan were not yet reflected in these requirements, the SAG, at its 6 December 1988 meeting, directed the study team to use requirements stated in the Modernization Plan as the basis for fleet development and costing. Requirements in this plan were for 58,258 LMTV trucks and 71,660 MTV trucks.

Further guidance was provided by the SAG at its 28 February 1989 meeting. At this time it was evident that, because of bugetary constraints, the Modernizat on Plan requirements for a total of 129,918 LMTV and MTV trucks would not be procured within the 30 year time period covered by this study. Thus, the SAG directed that the basis for fleet sizing and costing in this study should be the Tactical Wheeled Vehicle Modernization Plan Procurement Strategy which ODCSOPS was preparing and staffing at the time. This plan, eventually approved by the Army Chief of Staff on 13 April 1989, detailed a procurement objective of 30,467 LMTVs and 67,413 MTVs between 1991 and 2020. These numbers are the basis upon which the Baseline and alternative fleets presented in this section were developed.

3.1.1 Baseline Fleet and Primary Alternatives.

Each of the alternative fleets discussed below and presented in the tables that follow is fully payload capable of performing the cargo hauling missions currently assigned to the LMTV vehicles in the Baseline Fleet in the sense that sufficient equipment exists within the appropriate sections of all TOEs to carry all loads required as a part of either the unit's primary or secondary mission. Fleet characteristics such as deployability, transportability, mobility, etc. are discussed later in Section 4. The fact that no 5/4-ton trailers are included in any of the fleets presented in Table 3-1 will be addressed in paragraph 3.1.2, Special Interest Alternatives.

3.1.1.1 Baseline Fleet. This fleet represents that portion of the Tactical Wheeled Vehicle Modernization Plan fleet which is included in the Modernization Plan Procurement Strategy approved by the Army Chief of Staff on 13 April 1989. The Baseline Vehicle Fleet, developed as explained in Appendix III of Annex B, consists of 30,467 LMTV vehicles in two variants, 67,413 MTV vehicles in ten variants, and a total of 43,255 cargo trailers in three classes -- 1 1/2-ton, 2 1/2-ton, and 5-ton. The 5/4-ton class of cargo truck (HMMWV and CUCV) and the associated trailers are not included in the Baseline Fleet since vehicles of these types already existing in the Army force structure have no impact upon the results of this study. HMMWV and CUCV cargo vehicles and associated trailers, however, are included in the alternative fleets where they have been determined to be feasible substitutes for LMTV vehicles.

TABLE 3-1. ALTERNATIVE FLEET VEHICLE MIXES

VEHICLES			VEHICLES PER ALTERNATIVE				
TYPE	LIN	NOMENCLATURE	BASE	ALT 1	ALT 2	ALT 3	ALT 4
LMTV	Z40430	CARGO	28090	0	0	0	0
	Z94492	VAN	2377	0	0	0	0
MTV	Z40439	CARGO	21303	49393	48030	49343	47980
	Z40337	CARGO LWB	2225	2225	2225	2225	2225
	Z93626	CARGO W/MHE	5595	5595	5595	5595	5595
	Z93558	CARGO LWB W/MHE	270	270	270	270	270
	Z94560	VAN (EXPANDIBLE)	2292	4669	4669	4669	4669
	Z93669	DUMP	8022	8022	8022	8022	8022
	Z94433	WRECKER	5056	5056	5056	5056	5056
	Z94047	POL (1500 GAL)	674	674	674	674	674
	Z85341	TRACTOR	21953	21953	21953	21953	21953
	Z39788	AMBULANCE	23	23	23	23	23
HMMWV	T61494	CARGO	0	0	1524	0	1524
CUCV	T59482	CARGO	0	0	886	0	886
CARGO TRL	W95537	3/4-TON	0	0	1786	0	1786
	XXXXXX	5/4-TON	0	0	0	0	0
	W95811	1 1/2-TON	31518	31518	30676	31518	30676
	Z36068	2 1/2-TON LMTV	10910	10910	10859	10910	10859
	Z90712	5-TON MTV	827	827	827	827	827

3.1.1.2 <u>Alternative 1 - TWVRMO (HEAVY)</u>. This alternative fleet was developed by the TWVRMO at Fort Eustis, Virginia. As the TRADOC organization responsible for the review of all tactical wheeled vehicle requirements in TOE organizations, TWVRMO developed this alternative under the guidance provided in Army Regulation 71-13 which states, "Vehicles will be included in TOEs, MTOEs, TDAs, and JTAs in the minimum justified and approved quantities required to provide essential mobility to maintain the mission capabilities of units and activities." This alternative, in which, as indicated in Tables 3-2 and 3-3, the total number of trucks and trailers did not change from the Baseline Fleet, represents the straightforward substitution of MTVs for each LMTV in the Baseline Fleet. In Table 3-1 it can be seen that each of the 28,090 LMTV cargo vehicles in the Baseline Fleet becomes an MTV cargo vehicle and each of the 2,377 LMTV vans becomes an MTV van thus raising the number of MTV cargo and van vehicles to 49,393 and 4,669 respectively[1]. This alternative may also be referred to as the HEAVY alternative.

TABLE 3-2. TOTAL TRUCKS BY ALTERNATIVE

TYPE	BASE	ALT 1	ALT 2	ALT 3	ALT 4
LMTV	30467	0	0	0	0
MTV	67413	97880	96517	97830	96467
HMMWV	0	0	1524	0	1524
CUCV	0	0	886	0	886
TOTAL TRUCKS	97880	97880	98927	97830	98877
% CHANGE	N/A	0.0	+1.1	-0.1	+1.0

TABLE 3-3. TOTAL TRAILERS BY ALTERNATIVE

TYPE	BASE	ALT 1	ALT 2	ALT 3	ALT 4
3/4-TON	0	0	1786	0	1786
5/4-TON	0	0	0	0	0
1 1/2-TON	31518	31518	30676	31518	30676
2 1/2-TON LMTV	10910	10910	10859	10910	10859
5-TON MTV	827	827	827	827	827
TOTAL TRAILERS	43255	43255	44148	43255	44148
% CHANGE	N/A	0.0	+2.1	0.0	+2.1

3.1.1.3 Alternative 2 - LIGHT. This alternative, developed by Science Applications International Corporation (SAIC) and reviewed by TWVRMO for f asibility, represents the maximum downsizing of fleet vehicles which could be

[1] In this alternative, as in all other alternatives, it should be noted that the number of MTVs for each variant other than the cargo truck remain constant. This is because all LMTV vans must be converted to MTV vans and all LMTV cargo trucks are converted to either MTV cargo, HMMWV cargo, or CUCV cargo trucks. Cargo vehicles requiring long wheel bases (LWB) or material handling equipment (MHE) or a combination of these features were already converted to MTVs in the BIOP and hence in the Baseline Fleet.

achieved when the mission load requirements of each LMTV cargo vehicle in the Baseline Fleet are considered individually. This alternative contains a greater number of trucks (1.1%) and trailers (2.1%) than either the Baseline Fleet or Alternative 1 because in most cases where mission load characteristics would permit the substitution of 5/4-ton vehicles for LMTVs, two smaller vehicles or two smaller vehicles with trailers were required to provide the necessary mission load capability. While this fleet is fully payload capable as discussed above, the greater number of vehicles does have an impact upon fleet characteristics as will be discussed later.

This alternative fleet differs from the Alternative 1 fleet much less than was originally anticipated by the study team. The primary reason for this is that the baseline fleet, in terms of the capabilities of authorized vehicles, is very closely matched to the characteristics of the payloads which that fleet must transport. This resulted in the substitution of 5/4-ton trucks for less than 5% of al LMTVs. For the 95% of the LMTVs which were replaced by MTVs, approximately 40% were because of the LMTVs mission as prime mover for various non-cargo trailers or trailer mounted systems, approximately 50% were because the LMTV loads could not be configured to fit on smaller vehicles, and approximately 5% were because of secondary mission requirements for either the vehicle itself or the unit. Since 95% of the LMTVs were replaced by MTVs, this fleet is very similar to the Alternative 1 fleet.

3.1.1.4 Alternative 3 - HEAVY CONSOLIDATED. The substitution of one MTV cargo truck for each LMTV cargo truck in Alternative 1 increases the payload weight capacity by 100% (from 2 1/2- to 5 tons) and the payload cube capacity by 16.5% (from 405 cubic feet to 472 cubic feet) for each 2 1/2-ton mission payload within the fleet. If the payloads which must be hauled within a single TOE section or within two or more TOE sections are examined not individually but, instead, as a composite payload, then some of the increased weight or cube capacity of the cargo vehicles within the section or sections may be used to reduce the total number of cargo vehicles necessary to accomplish the section(s) mission. This alternative, like Alternative 2, developed by SAIC and reviewed by TWVRMO for feasibility, represents mission consolidations which may be made within the Alternative 1 fleet of vehicles using this concept. The effect of mission consolidation on the total number of trucks can be seen in the differences in the Alternatives 1 and 3 columns of Table 3-2.

Like Alternative 2, this alternative differs from Alternative 1 much less than originally anticipated by the study team. There are several reasons why fewer consolidation opportunities were identified than expected, including: the cube requirements of potential consolidated loads exceeded the MTV capacity; the number of prime movers required within a section/organization would not permit elimination of trucks; many trucks were assigned special function missions in support of a specific organization/subordinate unit and could not be eliminated; and, the requirement to assure the timely availability of sufficient vehicles to accomplish all unit missions often prevented elimination of trucks.

3.1.1.5 Alternative 4 - LIGHT CONSOLIDATED. Where 5/4-ton cargo trucks, with or without trailers, were substituted in Alternative 2 for LMTVs, the payload weight and cube capacity of the vehicles identified to perform a specific payload mission are not increased in the same way as when MTVs are substituted. Therefore, where downsizing of vehicles was accomplished in Alternative 2, the consolidation of missions within or across TOE sections was not feasible. Since, however, most of the vehicle substitutions in Alternative 2 are of the MTV variety, consolidation of missions was still possible in some circumstances. In fact, all mission consolidations achieved and reported in Alternative 3 were applicable also to the Alternative 2 Fleet. Thus, Alternative 4 is simply Alternative 2 with the mission consolidations of Alternative 3 applied. This can be seen in Table 3-2 in the slight decrease in the total number of MTV cargo trucks from Alternative 2 to Alternative 4.

3.1.1.6 Baseline and Alternative Fleet Mixes. The number of vehicles, both trucks and trailers, in the Baseline Fleet and each of four primary alternatives are presented by variant in Table 3-1.

The total number of trucks and trailers, by type, are presented for the Baseline Fleet and each primary alternative in Tables 3-2 and 3-3 respectively.

3.1.2 Special Interest Alternatives.

In addition to the Baseline and primary alternatives presented in paragraph 3.1.1, two special interest alternatives were investigated at the request of the SAG. Alternative 5 substitutes a 5/4-ton trailer for the 3/4-ton trailer and Alternative 6 replaces the CUCV with the HMMWV. These alternatives are described further in the following subparagraphs. Table 3-4 provides a comparison of these special interest fleets with the Alternative 4 LIGHT CONSOLIDATED fleet while Tables 3-5 and 3-6 indicate the total number of trucks and trailers, by type, in each alternative, again compared to the Alternative 4 fleet. Alternative 4 was chosen for comparison purposes because both special interest alternatives are, in a sense, sensitivities of the Alternative 4 Fleet mix to the existence or non-existence of equipment associated with the 5/4-ton class of vehicle.

TABLE 3-4. SPECIAL INTEREST FLEET VEHICLE MIXES

VEHICLES			VEHICLES / ALTERNATIVE		
TYPE	LIN	NOMENCLATURE	ALT 4	ALT 5	ALT 6
LMTV	Z40430	CARGO	0	0	0
	Z94492	VAN	0	0	0
MTV	Z40439	CARGO	47980	47980	47980
	Z40337	CARGO LWB	2225	2225	2225
	Z93626	CARGO W/MHE	5595	5595	5595
	Z93558	CARGO LWB W/MHE	270	270	270
	Z94560	VAN (EXPANDIBLE)	4669	4669	4669
	Z93669	DUMP	8022	8022	8022
	Z94433	WRECKER	5056	5056	5056
	Z94047	POL (1500 GAL)	674	674	674
	Z85341	TRACTOR	21953	21953	21953
	Z39788	AMBULANCE	23	23	23
HMMWV	T61494	CARGO	1524	1327	2410
CUCV	T59482	CARGO	886	771	0
CARGO TRL	W95537	3/4-TON	1786	1685	1786
	XXXXXX	5/4-TON	0	413	0
	W95811	1 1/2-TON	30676	30676	30676
	Z36068	2 1/2-TON LMTV	10859	10859	10859
	Z90712	5-TON MTV	827	827	827

TABLE 3-5. TOTAL TRUCKS FOR SPECIAL INTEREST ALTERNATIVES

TYPE	ALT 4	ALT 5	ALT 6
LMTV	0	0	0
MTV	96467	96467	96467
HMMWV	1524	1327	2410
CUCV	886	771	0
TOTAL TRUCKS	98877	98565	98877
% CHANGE FROM BASE	+1.0	+0.7	+1.0

TABLE 3-6. TOTAL TRAILERS FOR SPECIAL INTEREST ALTERNATIVES

TYPE	ALT 4	ALT 5	ALT 6
3/4-TON	1786	1685	1786
5/4-TON	0	413	0
1 1/2-TON	30676	30676	30676
2 1/2-TON LMTV	10859	10859	10859
5-TON MTV	827	827	827
TOTAL TRAILERS	44148	44460	44148
% CHANGE FROM BASE	+2.1	+2.8	+2.1

3.1.2.1 Alternative 5 - LIGHT CONSOLIDATED with 5/4-ton Trailer. The Army does not currently have in its inventory a 5/4-ton payload capacity cargo trailer which can be towed by a 5/4-ton HMMWV or CUCV. Since the 3/4-ton cargo trailer which these trucks now tow does not track properly with either truck, the use of this trailer with either vehicle significantly reduces the mobility of the truck/trailer combination. To overcome this mobility problem and to increase the payload capacity of the HMMWV/CUCV with trailer combination, the Army would like to have a "high mobility" trailer with a 5/4-ton payload capacity which could be towed by a HMMWV or a CUCV. Thus the SAG, at its initial meeting, directed the study team to consider the impact of a "high mobility", 5/4-ton payload capacity cargo trailer on the development of fleet alternatives. The impact of this "notional" trailer on the fleet mix and the cost of a fleet which includes this trailer may provide useful information in addressing any future decision by the Army as to whether or not to pursue the actual development and fielding of such a trailer.

As may be seen in Tables 3-4 through 3-6, the availability of a 5/4-ton trailer would result in a net increase of only 312 trailers in the fleet and a net decrease in the number of 5/4-ton trucks by the same number. While this number is perhaps smaller than anticipated, primarily because of the relatively low number of HMMWV/CUCV substitutions made in Alternative 4, it does represent a potential for the conversion of 13% of all 5/4-ton trucks in Alternative 4 to trailers. The details of the substitution methodology by which this alternative fleet was developed may be found in Appendix III of Annex B.

3.1.2.2 Alternative 6 - LIGHT CONSOLIDATED without the CUCV. The TWV Modernization Plan Procurement Strategy does not include provisions for the procurement of any new CUCVs during the 1991 to 2020 timeframe. Consequently, this alternative assumes that no new CUCVs will be procured and replaces each CUCV in Alternative 4 with a HMMWV cargo vehicle. This alternative is therefore identical to Alternative 4 except for the number of HMMWVs and CUCVs in the fleet.

3.1.3 Requirements Based Alternatives.

Because the Baseline mix of LMTV and MTV vehicles changes from 44.8% LMTV in the TWV Modernization Plan to only 31.1% LMTV in the Modernization Plan's Procurement Strategy, it was believed that the cost differential between the Baseline Fleet and the Alternatives would also vary depending upon which total baseline fleet is used. For comparison purposes the Baseline Fleet of 97,880 LMTV and MTV vehicles and the Alternative 4 Fleet presented in Tables 3-1 through 3-3 are presented in terms of the Modernization Plan total requirement of 129,918 LMTV and MTV vehicles in Tables 3-7 through 3-9.

Because of the different ratio of LMTV to MTV vehicles in the Baseline Fleet in Table 3-7 from that in Table 3-1, the percent change in the total number of trucks in Table 3-8 is 1.5% compared to 1.0% in Table 3-2 and the percent change in the total number of trailers in Table 3-9 is 3.0% compared to 2.1% in Table 3-3. These differences are also reflected in the fleet costs discussed in paragraph 3.2 below.

TABLE 3-7. MODERNIZATION PLAN FLEET VEHICLE MIXES

VEHICLES			VEHICLES / ALT	
TYPE	LIN	NOMENCLATURE	BASE	ALT 4
LMTV	Z40430	CARGO	53713	0
	Z94492	VAN	4545	0
MTV	Z40439	CARGO	22645	73654
	Z40337	CARGO LWB	2365	2365
	Z93626	CARGO W/MHE	5947	5947
	Z93558	CARGO LWB W/MHE	287	287
	Z94560	VAN (EXPANDIBLE)	2436	6981
	Z93669	DUMP	8528	8528
	Z94433	WRECKER	5375	5375
	Z94047	POL (1500 GAL)	716	716
	Z85341	TRACTOR	23336	23336
	Z39788	AMBULANCE	25	25
HMMWV	T61494	CARGO	0	2915
CUCV	T59482	CARGO	0	1695
CARGO TRL	W95537	3/4-TON	0	3416
	XXXXXX	5/4-TON	0	0
	W95811	1 1/2-TON	41834	40223
	Z36068	2 1/2-TON LMTV	14480	14383
	Z90712	5-TON MTV	1098	1098

TABLE 3-8. TOTAL TRUCKS FOR MODERNIZATION PLAN ALTERNATIVES

TYPE	BASE	ALT 4
LMTV	58258	0
MTV	71660	127214
HMMWV	0	2915
CUCV	0	1695
TOTAL TRUCKS	129918	131824
% CHANGE	N/A	+1.5

TABLE 3-9. TOTAL TRAILERS FOR MODERNIZATION PLAN ALTERNATIVES

TYPE	BASE	ALT 4
3/4-TON	0	3416
5/4-TON	0	0
1 1/2-TON	41834	40223
2 1/2-TON LMTV	14480	14383
5-TON MTV	1098	1098
TOTAL TRAILERS	57412	59120
% CHANGE	N/A	+3.0

3.2 COST ANALYSIS RESULTS

This section presents the results of the cost analysis methodology described in Section 2.2.

Table 3-10 provides the summary information for the Baseline and each Alternative fleet. All alternatives are more expensive. The actual cost differences vary from $1.07 billion to $1.14 billion over the 30 year study time frame. This difference is presented as a percent in Table 3-10. The percentage increase varies from 5.4% to 5.8%. In cost estimating, differences of less than ten percent are usually considered not significant. To highlight the differences, the total LCC is presented with residual value removed and with the fixed cost for the base case MTV fleet removed. Since all fleets are procured at about the same rate the residual value is very similar in every case. Table 3-11 presents the total number of vehicles in each alternative fleet. As this table shows, the majority of the substitutions were made with the MTV and, therefore, the preponderance of vehicles in any fleet is the MTV. Therefore, the residual values are very similar. Thus, the residual value analysis offers little insight. Since the MTV is the predominate vehicle, an analysis was performed to assess the magnitude of the MTV costs.

TABLE 3-10. COMPARISON FOR BASE CASE AND ALTERNATIVES (97,880)
(FY90 CONSTANT $ BILLIONS)

CATEGORY	B L	ALT 1	ALT 2	ALT 3	ALT 4	ALT 5	ALT 6
PRODUCTION	$10.18	$10.82	$10.77	$10.81	$10.76	$10.75	$10.76
FIELDING	1.20	1.31	1.30	1.31	1.30	1.30	1.30
SUS	8.24	8.63	8.63	8.63	8.63	8.63	8.63
TOTAL	19.62	20.76	20.70	20.75	20.69	20.68	20.69
CHANGE	--	5.8%	5.5%	5.8%	5.5%	5.4%	5.5%
RESIDUAL VALUE	$ 5.01	$ 5.45	$ 5.40	$ 5.45	$ 5.40	$ 5.40	$ 5.40
TOTAL LESS RESIDUAL	14.61	15.31	15.30	15.30	15.29	15.28	15.29
CHANGE	—	4.8%	4.7%	4.7%	4.7%	4.6%	4.7%
FIXED COST FOR MTV	$14.39	$14.39	$14.39	$14.39	$14.39	$14.39	$14.39
TOTAL W/O FIXED	5.23	6.37	6.31	6.36	6.30	6.29	6.30
CHANGE	--	21.8%	20.7%	21.6%	20.5%	20.3%	20.5%

TABLE 3-11. COMPARISON OF QUANTITIES FOR ALTERNATIVES

	B L	ALT 1	ALT 2	ALT 3	ALT 4	ALT 5	ALT 6
TRUCKS							
HMMWV	0	0	1,524	0	1,524	1,327	2,410
CUCV	0	0	886	0	886	771	0
LMTV	30,467	0	0	0	0	0	0
MTV	67,413	67,413	67,413	67,413	67,413	67,413	67,413
MTV(LMTV)	0	30,467	29,104	30,417	29,054	29,054	29,054
TOTAL	97,880	97,880	98,927	97,830	98,877	98,565	98,877
TRAILERS							
M101A2	0	0	1,786	0	1,786	1,685	1,786
M105A2	31,518	31,518	30,676	31,518	30,676	30,676	30,676
LMTV	10,910	10,910	10,859	10,910	10,859	10,859	10,859
MTV	827	827	827	827	827	827	827
TRAILER	0	0	0	0	0	413	0
TOTAL	43,255	43,255	44,148	43,255	44,148	44,460	44,148
FLEET	141,135	141,135	143,075	141,085	143,025	143,025	143,025

$14.39 billion of the total LCC for the Baseline and any Alternative are attributable to the 67,413 MTVs. When the cost impact of this large fixed cost is removed the actual cost difference remains the same. However, the percentage change is much more significant. When the MTV fixed costs are removed, the Alternative fleets vary from 20.3% to 21.8% more expensive than the baseline.

This study included the impact of repurchasing vehicle assets (rebuys) when vehicles reach their life expectancy. Since the period of this analysis is 30 years, this approach results in a significant number of vehicles being purchased to meet the 97,880 requirement. Table 3-12 provides the total number of vehicles purchased and costed in this analysis.

Figure 3-1, LCC Comparison by Phase, provides a visual display of the summary results in Table 3-10.

TABLE 3-12. ADDITIONAL ASSETS REQUIRED WHEN REBUYS ARE CONSIDERED

TOTAL TRUCKS WITH REBUYS

	B L	ALT 1	ALT 2	ALT 3	ALT 4	ALT 5	ALT 6
TRUCKS							
HMMWV	0	0	2,261	0	2,261	1,969	3,576
CUCV	0	0	2,204	0	2,204	1,918	0
LMTV	38,941	0	0	0	0	0	0
MTV	86,399	86,399	86,399	86,399	86,399	86,399	86,399
MTV (LMTV)	0	38,941	37,198	38,877	37,134	37,134	37,134
TOTAL	125,340	125,340	128,062	125,276	127,998	127,420	127,109
TRAILERS							
M101A2	0	0	1,786		1,786	1,685	1,786
M105A2	31,518	31,518	30,676	31,518	30,676	30,676	30,676
LMTV	10,910	10,910	10,859	10,910	10,859	10,859	10,859
MTV	827	827	827	827	827	827	827
TRAILER	0	0	0	0	0	413	0
TOTAL	43,255	43,255	44,148	43,255	44,148	44,460	44,148
FLEET	168,595	168,595	172,210	168,531	172,146	171,880	171,257

It should be noted that the Sustainment cost phase is only about 42% of the LCC total. This is a the normal result. Sustainment costs are expected to be at least 50% of most LCC studies. Since the procurement period (the time when vehicle assets are being procured) of this study is over the life of the study, the full impact of the sustainment cost differences are not recognized. An analysis of the truck cost data presented in Table 2-1 reveals that an MTV costs $7.9 thousand at the mid-point of its expected life. This compares with a mid-life sustainment cost of $4.5 thousand for the LMTV, $5.6 thousand for the MTV(LMTV), $1.55 thousand for the HMMWV, and $1.14 thousand for the CUCV. The sustainment cost for the MTV is 77% more costly than that for the LMTV, 393% more costly than the HMMWV and 558% more costly than the CUCV. This fact is summarized in Table 3-13, Comparison of Sustainment Costs.

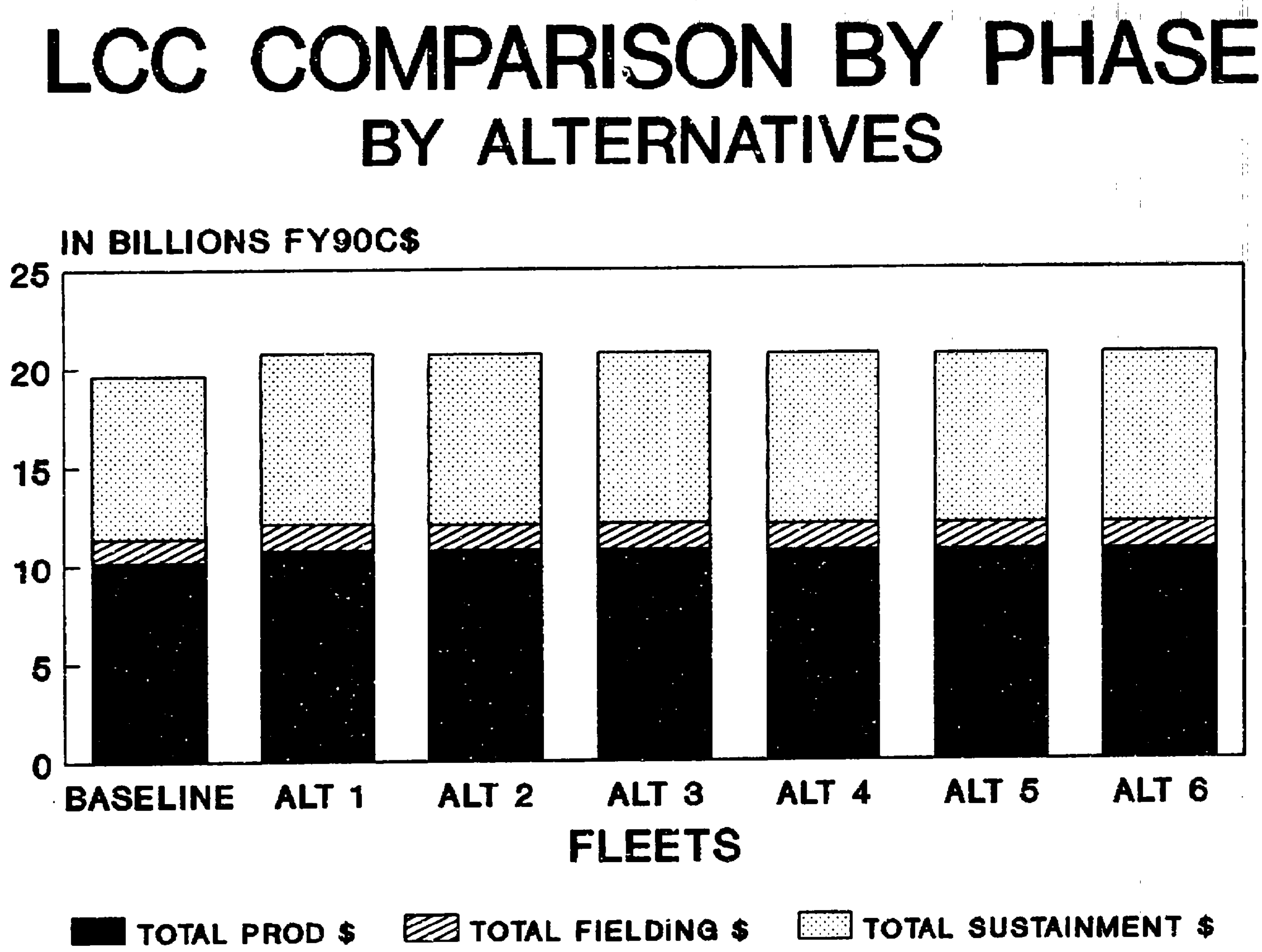

FIGURE 3-1. LCC COMPARISON BY PHASE

TABLE 3-13. COMPARISON OF SUSTAINMENT COSTS
(FY90 CONSTANT $ THOUSANDS)

VEHICLE	ANNUAL SUSTAINMENT	% INCREASE TO MTV
MTV	$7.9	---
LMTV	$4.5	75.6%
HMMWV	$1.6	393.8%
CUCV	$1.2	558.3%
MTV(LMTV)	$5.6	41.1%

When the effects of annual sustainment costs in Table 3-13 are computed, the cost impact of the MTV substitution is seen more readily. This analysis is summarized in Table 3-14. This table shows that the annual sustainment cost increase for the alternative fleets is about 4.5 % per year against a base of $669 thousand. This is an actual cost increase of about $30 million per year. This $30 million is essentially an O&M funding increase. The costs estimates in Table 3-14 were generated by multipling the annual sustainment cost in Table 3-13 by the vehicle quantities in Table 3-14.

TABLE 3-14. SUSTAINMENT COST IMPACTS ON FULLY FIELDED REQUIREMENT
(FY90 CONSTANT $ MILLIONS)

	B L	ALT 1	ALT 2	ALT 3	ALT 4	ALT 5	ALT 6
VEHICLE QUANTITIES							
HMMWV	0	0	1,524	0	1,524	1,327	2,410
CUCV	0	0	886	0	886	771	0
LMTV	30,467	0	0	0	0	0	0
MTV	67,413	67,413	67,413	67,413	67,413	67,413	67,413
MTV(LMTV)	0	30,467	29,104	30,417	29,054	29,054	29,054
TOTAL	97,880	97,880	98,927	97,830	98,877	98,565	98,877
TOTAL ANNUAL SUSTAINMENT COSTS (ALL VEHICLES OPERATIONAL)							
COST	$669	$702	$698	$702	$698	$697	$698
%INCREASE		4.9%	4.3%	4.9%	4.3%	4.2%	4.3%

The impact of inflation is presented in Annex C, Cost Analysis Detail. Figure 3-2 presents the cumulative funding requirement for the Baseline. Cumulative funding profiles for all alternatives are presented in Annex C. The profiles for alternatives 1-6 are not presented here since the annual procurement schedules are so similar.

3.3 SUMMARY OF RESULTS

Cost estimates are generally considered to be no more than 90 percent accurate. Since the estimates for each alternative are within six percent of each other it is concluded that there is no significant cost difference between the alternatives. However, on the basis of the empirical cost estimating model in this analysis, it is reasonable to conclude that the baseline fleet is the least expensive fleet for the Army to own and operate. As a measure of cost comparison, life cycle cost estimates for the baseline and each alternative fleet have been developed. The evidence indicates that a substitution for the LMTV truck will increase investment costs and that each alternative fleet will incur a $30 million annual increase in the direct operating costs over the 30 year study period.

Section 5.0 presents sensitivity analyses on the Baseline and Alternative fleets. Once again the sensitivities provide little insight due to the fact that few non-MTV assets are found in the alternative fleets.

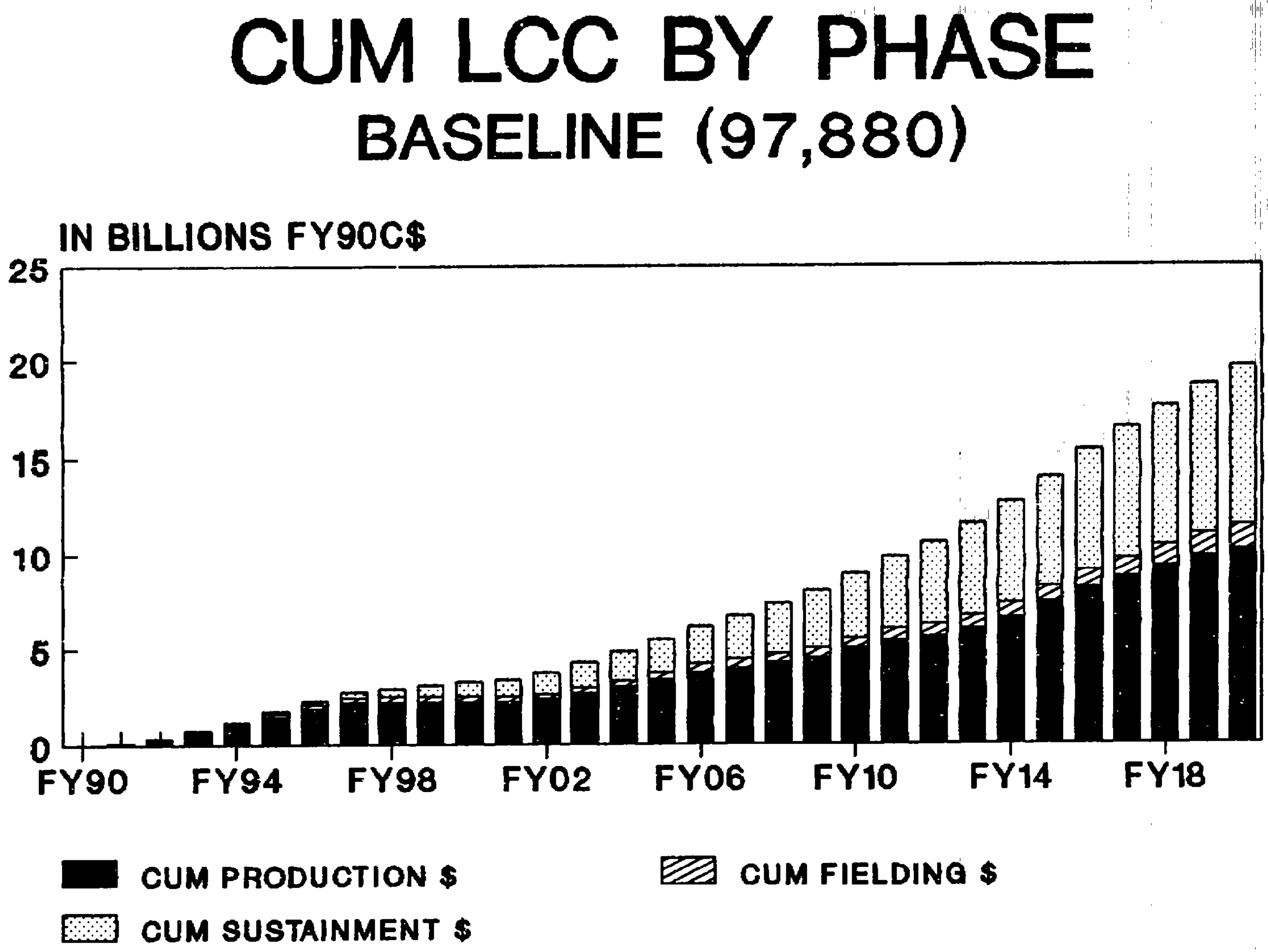

FIGURE 3-2. CUMULATIVE LIFE CYCLE COSTS

SECTION 4

FLEET CHARACTERISTICS

The fleet characteristics of the Baseline and Alternative Fleets described in Table 3-1 are presented in this section. These fleet characteristics include payload capacity, strategic deployability, mobility, transportability, manpower requirements, and operational impacts.

4.1 PAYLOAD CAPACITY

The payload capacities of the Baseline and Alternative Fleets were calculated and are presented in this paragraph. Only the payload capacities of the LMTV, MTV, HMMWV, and CUCV cargo trucks and associated cargo trailers were included in these calculations. MTV LWB trucks and MTV cargo trucks equipped with MHE were not included as the number of these trucks is constant across all fleets considered.

Table 4-1 presents the payload weight and cube capacities of each vehicle as described in Appendix II of Annex B.

TABLE 4-1. VEHICLE PAYLOAD CAPACITIES

VEHICLES			CAPACITIES	
TYPE	LIN	NOMENCLATURE	WT(LB)	CUBE(FT)
LMTV	Z40430	CARGO	5000	405
MTV	Z40439	CARGO	10000	472
HMMWV	T61494	CARGO	2100	190
CUCV	T59482	CARGO	2500	184
TRL	W95537	3/4-TON	1500	170
"	XXXXXX	5/4-TON	2500	176
"	W95811	1 1/2-TON	3000	278
"	Z36068	2 1/2-TON LMTV	5000	405
"	Z90712	5-TON MTV	10000	472

Table 4-2 provides a comparison of the payload capacities of the Alternative Fleets with those of the Baseline Fleet.

Alternative 1 reflects the greatest increase in both weight and cube capacity because each of the Baseline Fleet's 28090 LMTV cargo trucks is replaced by an MTV cargo truck in this alternative.

TABLE 4-2. ALTERNATIVE FLEET PAYLOAD CAPACITIES

ALTERNATIVE	WEIGHT TONS(000)	WEIGHT % OF BASE	CUBE FEET(000)	CUBE % OF BASE
BASELINE	255.4	100.0	35002.4	100.0
1 TWVRMO (HVY)	325.7	127.5	36884.4	105.4
2 LIGHT	318.5	124.7	36742.5	105.0
3 HEAVY-CONSO	325.4	127.4	36860.8	105.3
4 LIGHT-CONSO	318.2	124.6	36718.9	104.9

The increases shown for Alternative 2, although significant from the Baseline, are less than those for Alternative 1 because of the decreased number of MTV trucks (1363) and the increased number of 5/4-ton trucks (2410) in this alternative when compared to Alternative 1.

The minimal effects of vehicle mission consolidation on fleet payload capacities can be seen by comparing the results shown for Alternatives 3 and 4 with those of Alternatives 1 and 2 respectively.

While these increases in fleet payload capacity may be useful in providing added load capacity to Army units and perhaps offsetting some future requirement for additional vehicles for a given TOE, the additional capacity is not needed to accomplish the unit's current mission.

4.2 STRATEGIC DEPLOYABILITY

Simulated air deployments of divisional baseline and alternative fleets were conducted to determine the impact of fleet alternatives upon strategic transport requirements. A complete description of this analysis, which is summarized in this paragraph, is included at Appendix IV of Annex B.

Notional type division structures for both Light and Heavy divisions, as well as division structures for the Airborne and Air Assault divisions, were provided by TWVRMO from a TRADOC computer data base. Since all divisional SRCs were included in the subset of SRCs on which detailed substitution analysis was conducted, baseline and alternative 2 1/2 and 5-ton vehicle fleets were developed based upon the divisional structures provided by TWVRMO.

With the assistance of the US Army Logistics Center, Fort Lee, Virginia, air deployments were modeled using the Automated Aircraft Load Planning System (AALPS). Strategic, as opposed to tactical, deployments were modeled using C-141B aircraft with an Aircraft Load (ACL) of 60,000 lb. Modeled deployments for each division type included only study vehicles, i.e., LMTV and MTV trucks and associated trailers and only those HMMWV and CUCV cargo vehicles with trailers identified as substitute vehicles within the units of the division. So that comparisons might be made of the impact of alternative truck fleets upon the deployment of entire divisions, the number of sorties required to move full Light, Airborne, and Air Assault divisions was obtained from the Combined Arms Center (CAC) at Fort Leavenworth and are included in this analysis. However, since these divisional deployment requirements are not necessarily representative of FMTV equipped divisions, they are used in this analysis to provide only an estimate of the relative impact of alternative fleets. Because heavy divisions are not deployed by this means, deployment data for a full heavy division was not available from CAC.

Tables 4-3 through 4-5 provide comparisons of the strategic deployment assets, in terms of sorties, required to move three of the four division types under the Baseline and Alternative Fleet configurations.

TABLE 4-3. STRATEGIC DEPLOYMENT OF THE AIRBORNE DIVISION

ALTERNATIVE	STUDY VEHICLES ONLY SORTIES	STUDY VEHICLES ONLY % OF BASE	FULL DIVISION SORTIES	FULL DIVISION % OF BASE
BASELINE	250	100.0	703	100.0
1 TWVRMO (HVY)	316	126.4	769	109.4
2 LIGHT	302	120.8	755	107.4
3 HEAVY-CONSO	308	123.2	761	108.3
4 LIGHT-CONSO	294	117.6	747	106.3

TABLE 4-4. STRATEGIC DEPLOYMENT OF THE AIR ASSAULT DIVISION

ALTERNATIVE	STUDY VEHICLES ONLY SORTIES	STUDY VEHICLES ONLY % OF BASE	FULL DIVISION SORTIES	FULL DIVISION % OF BASE
BASELINE	365	100.0	1154	100.0
1 TWVRMO (HVY)	434	118.9	1223	106.0
2 LIGHT	429	117.5	1218	105.5
3 HEAVY-CONSO	432	118.4	1221	105.8
4 LIGHT-CONSO	427	117.0	1216	105.4

TABLE 4-5. STRATEGIC DEPLOYMENT OF A HEAVY DIVISION

ALTERNATIVE	STUDY VEHICLES ONLY SORTIES	STUDY VEHICLES ONLY % OF BASE	FULL DIVISION SORTIES / % OF BASE
BASELINE	555	100.0	THE HEAVY
1 TWVRMO (HVY)	655	118.0	DIVISIONS
2 LIGHT	651	117.3	ARE NOT
3 HEAVY-CONSO	654	117.8	DEPLOYED
4 LIGHT-CONSO	650	117.1	BY AIR

Although Alternatives 2 and 4 have a greater number of vehicles than Alternatives 1 and 3 in each of the three division types presented above, these alternatives require fewer sorties because the vehicles are smaller and a greater number of them can be loaded on each aircraft.[1]

The lack of significant differences between the alternatives in the Air Assault (427 to 434 sorties) and Heavy (650 to 655 sorties) divisions is caused by the fact that in the TOE organizations of these divisions there are relatively few instances where LMTVs may be substituted for by the smaller 5/4-ton class of vehicles. In the TOEs of the Air Assault division only 5.9% of the LMTVs in the Baseline Fleet are replaced in Alternative 2 by 5/4-ton trucks while only 4.5% of this type substitution can be made in the Heavy division TOEs. By contrast, the number of sorties varies among alternative from 294 to 316 in the Airborne division because 14.4% of the LMTVs in that division are downsized in Alternative 2.

Figure 4-6 demonstrates that the elimination of the 2 1/2-ton class of trucks from the Army fleet has no impact on the deployability of a Light division because light divisions have only one LMTV - in the division band. This vehicle, which because of a secondary mission of transporting personnel and in time of war, prisoners, was converted to an MTV cargo truck in all alternatives and had no impact upon the deployability of the division.

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[1] As pointed out by the Project Manager, Light Tactical Vehicles, at the SAG IV meeting, deployability advantages could be realized through the mounting of some S-280 shelters on Dual Wheeled CUCVs thus providing a roll-on/roll-off capability for these systems when either the C-141 or the C-130 aircraft was used. Since Dual Wheeled CUCVs were not included in this analysis, potential deployability advantages of using these vehicles are not reflected in results presented here.

TABLE 4-6. STRATEGIC DEPLOYMENT OF A LIGHT DIVISION

ALTERNATIVE	STUDY VEHICLES ONLY SORTIES % OF BASE	FULL DIVISION SORTIES	FULL DIVISION % OF BASE
BASELINE	THE LIGHT	521	100.0
1. TWVRMO (HVY)	DIVISIONS	521	100.0
2. LIGHT	HAVE ONLY 1	521	100.0
3. HEAVY-CONSO	2 1/2-TON	521	100.0
4. LIGHT-CONSO	TRUCK	521	100.0

Elimination of the 2 1/2-ton class of truck would have a negative impact on the deployability of the Airborne and Air Assault divisions. An increase of approximately 5 to 10% in the number of sorties required to accomplish strategic deployment of these divisions could be expected.

4.3 MOBILITY

An analysis of the mobility performance of alternative vehicles under various surface conditions and scenarios was performed for the Deputy Under Secretary of the Army (Operations Research) by the US Army Engineer Waterways Experiment Station (WES) during the period January-April 1989. Simplified results of the analysis are displayed in Table 4-7.

TABLE 4-7. MOBILITY COMPARISON OF ALTERNATIVE VEHICLE COMBINATIONS

CANDIDATES	PREFERRED
MTV vs LMTV	Similar
MTV vs LMTV w/trailers	MTV
MTV w/trailers vs LMTV w/trailers	MTV
CUCV vs LMTV	LMTV
CUCV w/trailers vs LMTV	LMTV
HMMWV vs LMTV	LMTV
HMMWV w/trailers vs LMTV	LMTV
HMMWV w/trailers vs LMTV w/trailers	LMTV

Relating these results to the alternative fleets leads to the following observations. Since only the MTV substitutes for the LMTV in the heavy alternatives (1 and 3) and since in most cases these substitutions involve trailers, these alternatives should have slightly better mobility than the Baseline fleet. In the light alternatives (2 and 4), the preponderance of substitutions (more than 97%) is again the MTV with trailer for the LMTV with trailer. Thus, these alternatives also should have slightly better mobility than the Baseline Fleet. Alternatives 2 and 4 have slightly worse mobility than Alternatives 1 and 3 because the small numbers of CUCV and HMMWV with trailers are less mobile than the LMTV. An assessment of the impact of mobility on mission capability was beyond the scope of this analysis.

4.4 TRANSPORTABILITY

The transportability of LMTV, MTV, HMMWV, and CUCV cargo trucks by two Army helicopters, the CH-47D Chinook medium lift helicopter and the UH-60A Black Hawk utility/assault helicopter, was reviewed to assess the impact of alternative vehicle fleets on the tactical movement capabilities of Army units. Only cargo trucks were considered in this analysis since the number of all other truck variants are constant across all fleets and all trailers are transportable by both types of helicopters considered.

FMTV system specifications require that both the LMTV and MTV cargo trucks be externally transportable by the CH-47D helicopter. Since both the HMMWV and CUCV cargo trucks are also fully transportable by this aircraft, the cargo trucks of the Baseline and all Alternative Fleets are 100% transportable by the Army's medium lift helicopter.

FMTV vehicles are not transportable by the UH-60A aircraft; HMMWV and CUCV cargo trucks which are found in Alternatives 2 and 4 are transportable. Table 4-8 presents the percentage of cargo trucks in each vehicle fleet which are transportable by the respective helicopters.

While Alternative Fleets 2 and 4 do possess some transportability advantages over the Baseline Fleet and Alternative Fleets 1 and 3, the value of this advantage should be weighted by the fact that there is currently no requirement for the LMTV vehicles in the Baseline Fleet which were replaced by these 5/4-ton vehicles to be transported by this means.

TABLE 4-8. ALTERNATIVE FLEET TRANSPORTABILITY

ALTERNATIVE	PERCENT OF CARGO TRUCKS TRANSPORTABLE UH-60A BLACK HAWK	UH-47D CHINOOK
BASELINE	0.0	100.0
1 TWVRMO (HVY)	0.0	100.0
2 LIGHT	4.8	100.0
3 HEAVY-CONSO	0.0	100.0
4 LIGHT-CONSO	4.8	100.0

4.5 MANPOWER REQUIREMENTS

The number of drivers and maintenance personnel required to operate and support each of the alternative fleets was calculated to determine the impact of alternative fleets on Army personnel requirements. Because of frequent changes in the structure and functions of the various Military Occupational Specialties (MOS), specific MOSs were not addressed in this analysis.

Personnel requirements were calculated during the cost analysis phase of this study. Driver requirements were determined based upon the assumption that the assignment of drivers was dependent upon the role of the vehicle and not upon the type of vehicle as explained in Section 2.2. Requirements for maintenance personnel were based upon maintenance data provided by TACOM. The costs associated with personnel requirements for each alternative are incorporated into the cost analysis results presented in Section 3.2.

Table 4-9 presents the number of drivers and maintenance personnel required for the Baseline and Alternative Fleets and the percent change in requirements for each Alternative Fleet from the Baseline Fleet requirements.

TABLE 4-9. ALTERNATIVE FLEET PERSONNEL REQUIREMENTS

ALTERNATIVE	DRIVERS REQ'D	DRIVERS % OF BASE	MAINTENANCE PERSONNEL REQ'D	MAINTENANCE PERSONNEL % OF BASE
BASELINE	19900	100.0	15816	100.0
1 TWVRMO (HVY)	19900	100.0	16995	107.5
2 LIGHT	20005	100.5	17043	107.8
3 HEAVY-CONSO	19895	100.0-	16987	107.4
4 LIGHT-CONSO	20000	100.5	17035	107.7

Driver requirements for Alternatives 2 and 4 are 105 and 100 higher than those of the Baseline Fleet respectively, because 5/4-ton vehicles substitute for LMTV vehicles in most cases on a two for one basis and require 0.1 drivers each rather than 0.1 driver for the single LMTV replaced. Alternative 1 has the same number of trucks as the Baseline Fleet thus requiring the same number of drivers; Alternative 3 has 50 fewer trucks and a requirement for 5 fewer drivers than the Baseline Fleet.

With respect to maintenance personnel requirements, each alternative requires approximately 1200 more personnel than the Baseline Fleet. This requirement is caused by the significantly greater number of MTVs in each of the alternatives and the greater number of total vehicles in Alternatives 2, 3, and 4.

As expected the greatest increase in personnel requirements may be seen in Alternative 2. This is because this alternative has the greatest number of total trucks with increased driver requirements and because, like the other alternatives, most of the LMTVs in the Baseline Fleet have been converted to MTVs, each with greater maintenance requirements.

Any requirement for increased personnel strength in a particular Military Occupational Specialty (MOS) may of course be satisfied by either increasing the end strength of the Army or by maintaining the end strength and reducing strength in another "billpayer" MOS. This study has made no attempt to resolve this difficult issue. It is possible, however, to provide some data which may be of interest to decisionmakers. Specifically, this is the cost of the additional personnel required by each alternative.

If one assumes that the cost of recruiting and training a soldier in a "billpayer" MOS is the same as recruiting and training a driver or maintenance specialist, then the personnel portion of the total LCC costs, in millions, of each alternative is the amount shown in Table 4-10.

TABLE 4-10. COST IMPLICATIONS OF ADDITIONAL DRIVER AND MAINTENANCE PERSONNEL

ALTERNATIVE	TOTAL PERSONNEL	PERSONNEL COST ($M)	PERCENT CHANGE
BASELINE	35,716	$883	---
1 TWVRMO (HVY)	36,895	$912	+3.3%
2 LIGHT	37,048	$920	+4.2%
3 HEAVY-CONSO	36,882	$912	+3.3%
4 LIGHT-CONSO	37,035	$919	+4.1%

4.6 OPERATIONAL IMPACT

The purpose of this study was to examine the feasibility of eliminating the 2 1/2-ton (LMTV) class of trucks from the Army's tactical wheeled vehicle fleet. As outlined in Section 2.1 and detailed in Annex B, the methodology employed was to examine the individual missions, both primary and secondary, of each LMTV in a representative subset of all Active Army, National Guard, Army

Reserve, and POMCUS organizations. Since the mission of all LMTVs, both cargo and van, is to transport cargo, the focus was on identifying alternative sets of vehicles which could perform the LMTV's cargo hauling mission.

While developing alternative vehicle sets, the study team specifically emphasized the identification of, first, the maximum number of LMTV missions for which vehicles from the 5/4-ton class could be substituted, and, secondly, any LMTV mission which could not be accomplished by alternative vehicles from either the 5/4-ton or 5-ton classes. Identification of the maximum number of 5/4-ton vehicle substitutions was sought to reduce the cost of alternative fleets while identification of "show stopper" missions would mean that it was <u>not</u> feasible to eliminate the entire LMTV class of vehicles.

To verify that all vehicle substitutions recommended by the study team were in fact feasible, each substitution was reviewed with the Army's TWVRMO at Fort Eustis, Virginia. Only those substitutions deemed feasible, although often not preferable, by TWVRMO were included in the alternative fleets. This process resulted in the identification of <u>NO</u> "show stopper" LMTV missions and ensured that each alternative fleet was fully capable of accomplishing the cargo hauling missions of the LMTVs in the Baseline Fleet.

As is evidenced by this section of the report, however, the impact of the development of alternative fleets on the operational capabilities of Army units may, depending upon the unit, go beyond the simple ability to transport a specific payload. Each of the fleet characteristics discussed in this section may or may not have an impact upon a specific unit or organization and the magnitude of that impact, be it positive or negative, may be perceived differently even by individuals within the organization. Although this study makes no attempt to resolve these issues explicitly, the impact of the fleet characteristics discussed in this section is considered in Section 6, Summary of Analysis.

SECTION 5

COST SENSITIVITY ANALYSES

Sensitivity analyses were developed to identify cost drivers and present implications of key assumptions and ground rules. Five cost sensitivities were investigated. A separate Logistics Assessment is also included in this section.

- Sensitivity 1 presents the cost of alternative fleets using the ODSCOPS mod plan constrained funding stream for LMTV and MTV vehicles and trailers.
- Sensitivity 2 presents the cost implications of alternative vehicle lives for the CUCV and HMMWV. Currently the lives are projected to be 7 and 14 years, respectively. This sensitivity changes the projected lives to 14 and 21 years, respectively.
- Sensitivity 3 presents the cost implications of a 50 percent increase in annual miles for the 5/4 ton vehicles performing in the LMTV role.
- Sensitivity 4 presents the cost increase due to an increase in assigned drivers from 0.1 to 0.25 for the MTV when performing in the LMTV role and a decrease in drivers from 0.1 to 0 for the 5/4 ton vehicle when performing in the LMTV role.
- Sensitivity 5 presents a 130,000 truck scenario procured in 15 years.
- A Logistics Assessment is provided to highlight the logistics impacts of removing the LMTV from the FMTV fleet.

5.1 SENSITIVITY 1 - FISCALLY CONSTRAINED MODEL

Sensitivity 1 presents the cost of alternative fleets using the ODSCOPS modernization plan procurement strategy constrained funding stream for the LMTV and MTV vehicles. The purpose of this sensitivity is to show the funding necessary to procure the fleet quantity for each altenative and stay within the ODCSOPS funding profile. One additional year was necessary to procure all 97,880 vehicles in the baseline fleet as well as the total quantity in each alternative fleet. Table 5-1 presents the LCC through the year 2021. As Table 5-1 shows, the cost increase between alternatives remains in the six percent range. Thus, it is concluded that a constrained funding approach would have no significant impact upon the relative ranking of the alternatives. It can also be recognized that the additional procurement adds less than aone percent increase in total life cycle cost to each alternative.

TABLE 5-1. SUMMARY RESULTS SENSITIVITY ANALYSIS 1
(FY90 Constant Billions)

	B L	ALT 1	ALT 2	ALT 3	ALT 4	ALT 5	ALT 6
PROD	$10.18	$10.58	$10.55	$10.58	$10.54	$10.54	$10.54
FL	1.20	1.29	1.30	1.29	1.30	1.30	1.29
SUS	8.24	8.80	8.87	8.80	8.87	8.87	8.87
TOT	$19.62	$20.67	$20.72	$20.67	$20.71	$20.71	$20.70
%CHANGE	--	5.35%	5.61%	5.35%	5.56%	5.56%	5.50%
INITIAL EST	$19.62	$20.76	$20.70	$20.75	$20.69	$20.68	$20.69
VARIATION FROM INITIAL EST	--	0.09%	0.02%	0.08%	0.02%	0.03%	0.01%

5.2 SENSITIVITY 2 - ALTERNATIVE VEHICLE LIVES

Sensitivity 2 presents the cost implications of alternative vehicle lives for the CUCV and HMMWV. Currently the lives are projected to be 7 and 14 years, respectively. This sensitivity changes the projected lives to 14 and 21 years, respectively. The purpose of this sensitivity is to present the sensitivity of results to changes in expected life. In this analysis cost effects of vehicle life increases for the HMMWV and CUCV are obscured since their quantities are so small. Table 5-2 presents the LCC in constant dollars, the percent change between alternatives and the relative change form the initial estimates. As this table shows, vehicle life increases do not change the relative differences between alternatives. HMMWV and CUCV life increases do provide for cost savings of less than one ten of a percent. These changes are well within the error of the estimates and cannot be considered significant for differentiation between alternatives.

TABLE 5-2. SUMMARY RESULTS SENSITIVITY ANALYSIS 2
(FY90 Constant Millions)

	B L	ALT 1	ALT 2	ALT 3	ALT 4	ALT 5	ALT 6
PROD	$10.18	$10.82	$10.74	$10.81	$10.74	$10.73	$10.74
FL	1.20	1.31	1.30	1.31	1.30	1.30	1.30
SUS	8.24	8.63	8.64	8.63	8.64	8.63	8.64
TOT	$19.62	$20.76	$20.68	$20.75	$20.68	$20.66	$20.68
%CHANGE	--	5.81%	5.40%	5.81%	5.40%	5.30%	5.40%
INITIAL EST	$19.62	$20.76	$20.70	$20.75	$20.69	$20.68	$20.69
VARIATION FROM INITIAL EST	--	0.00%	0.02%	0.00%	0.01%	0.02%	0.01%

5.3 SENSITIVITY 3 - INCREASE IN ANNUAL MILES

Sensitivity 3 presents the cost implications of a 50% increase in annual miles for the 5/4-ton vehicles performing in the LMTV role. Annual miles for vehicle in the LMTV role increased from 2,512 to 3,768. The purpose of this sensitivity is to quantify the impact of annual miles on the alternative estimates. Table 5-3 presents the LCC in constant dollars. As this table shows, annual mile increases do not change the relative differences between alternatives. Annual mile increases do provide for cost increases of approximately one tenth of a percent. The relative difference between alternatives and the Baseline remains in the 6% range. These changes are well within the error of the estimates and cannot be considered significant for differentiation between alternatives.

TABLE 5-3. SUMMARY RESULTS SENSITIVITY ANALYSIS 3
(FY90 Constant Millions)

	B L	ALT 1	ALT 2	ALT 3	ALT 4	ALT 5	ALT 6
PROD	$10.18	$10.82	$10.77	$10.81	$10.76	$10.75	$10.76
FL	$1.20	$1.31	$1.30	$1.31	$1.30	$1.30	$1.30
SUS	$8.24	$8.63	$8.65	$8.63	$8.64	$8.64	$8.65
TOT	$19.62	$20.76	$20.72	$20.75	$20.70	$20.69	$20.71
%CHANGE	--	5.81%	5.61%	5.81%	5.50%	5.45%	5.56%
INITIAL EST	$19.62	$20.76	$20.70	$20.75	$20.69	$20.68	$20.69
VARIATION FROM INITIAL EST	--	0.00%	0.02%	-0.00%	-0.01%	-0.01%	-0.02%

5.4 SENSITIVITY 4 - INCREASE DUE TO ASSIGNED DRIVERS

Sensitivity 4 presents the cost increase due to an increase in assigned drivers from 0.1 to 0.25 for the MTV when performing in the LMTV role and a decrease in drivers from 0.1 to 0 for the 5/4-ton vehicle when performing in the LMTV role. The purpose of this analysis is to highlight potential personnel impacts due to changes in assigned drivers. Table 5-4 presents the LCC in constant dollars. As this table shows, assigned driver changes do not change the relative differences between alternatives. Assigned driver changes do provide for cost increases of approximately one to two percent. The relative difference between alternatives and the base line increases from the six percent range to the eight percent range. These changes are within the error of the estimates and can not be considered significant for differentiation between alternatives. A more complete assessment of personnel (maintenance and driver impacts) is provided in Section 4.5 of this report.

TABLE 5-4. SUMMARY RESULTS SENSITIVITY ANALYSIS 4
(FY90 Constant Millions)

	B L	ALT 1	ALT 2	ALT 3	ALT 4	ALT 5	ALT 6
PROD	$10.18	$10.82	$10.77	$10.82	$10.76	$10.75	$10.76
FL	$1.20	$1.31	$1.30	$1.31	$1.30	$1.30	$1.30
SUS	$8.24	$8.78	$8.77	$8.77	$8.77	$8.77	$8.77
TOT	$19.62	$20.91	$20.84	$20.90	$20.83	$20.82	$20.83
%CHANGE	--	6.57%	6.22%	6.52%	6.17%	6.12%	6.17%
INITIAL EST	$19.62	$20.76	$20.76	$20.75	$20.69	$20.68	$20.69
VARIATION	--	0.15%	0.14%	0.15%	0.14%	0.14%	0.14%

5.5 SENSITIVITY 5

Sensitivity 5 presents a 130,000 truck procurement over 15 years. The sustainment phase for this sensitivity remains the same as the other models, FY90-FY2020. The purpose of this analysis was to provide a comparable value to previous studies and present the impacts of an accelerated acquisition schedule. Only the Base Line and Alternative 4 were analyzed. Table 5-5 presents the LCC in constant dollars. A more accelerated acquisition schedule does increase the difference between alternatives. Alternative 4 is fifteen percent more costly than the base case when accelerated acquisition is considered. This difference is marginally significant. The key factor driving this difference is the longer sustainment period since procurement is completed earlier. The effect of increased sustainment costs is discussed in Section 3.2 and Table 3-14. As Table 5-5 illustrates, the cost of the fleet increases by 50 percent to 64 percent due to increased operating costs.

TABLE 5-5. SUMMARY RESULTS SENSITIVITY ANALYSIS 5
(FY90 Constant Millions)

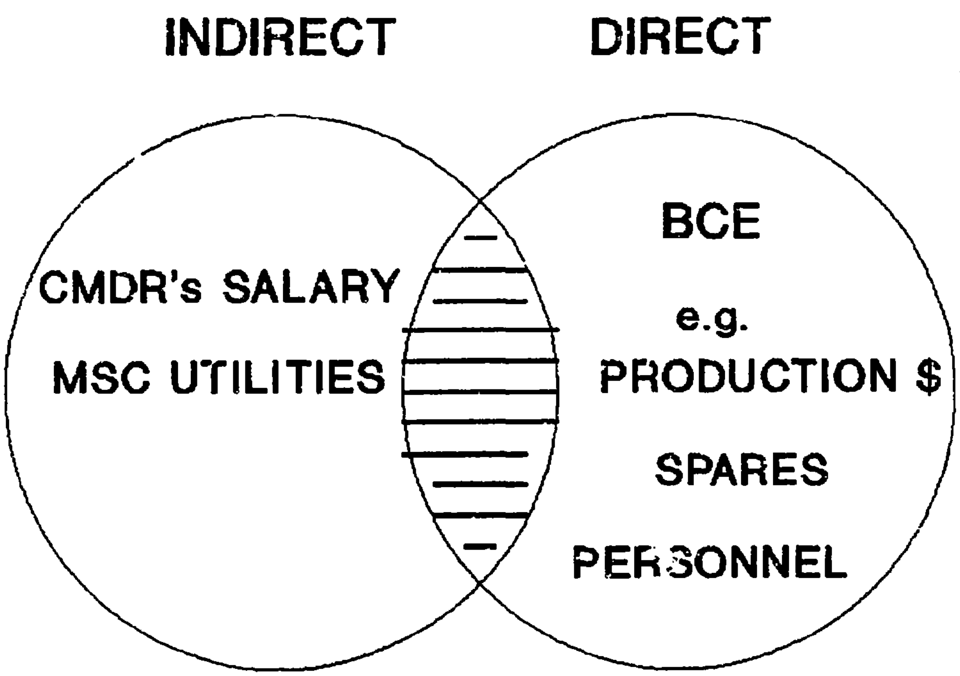
	B L	ALT 4
PRODUCTION	$15.88	$16.81
FIELDING	$ 1.86	$ 2.04
SUSTAINMENT	$11.84	$15.08
TOTAL LCC	$29.58	$33.93
%CHANGE	--	14.71%
INITIAL		
EST	$19.62	$20.69
VARIATION	50.76%	63.99%

5.6 LOGISTICS ASSESSMENT

5.6.1 Introduction.

The purpose of this analysis is to present the cost implications of the removal of the LMTV from the FM family. This analysis highlights those cost impacts not readily apparent in the LCC analysis presented in Sections 2.2 and 3.2 of this report. The Army instructions for cost analysis preparation, Instructions fo. Reformatting the BCE/ICE, DCA-P-92(R), provide definitions and cost element categories designed to capture all costs directly associated with a weapon system. Indirect costs, such as a prorated share of the Commander's salary at an Army Major Subordinate Command (MSC), are not included. Figure 5-1 below depicts the segment of costs included in logistics analysis. Cost elements such as the increase or decrease in initial spares or the increase in maintenance personnel are included in the LCC analysis. The objective of this analysis is to quantify the logistic impacts through an examination of operator, maintenance and system level logistic functions. While the composition of logistics support requirements for the FMTV covers many individual elements such as manpower and personnel, maintenance planning, facilities and training, this analysis focuses on seven particular elements. Specifically, these elements are Special Tools and Test Maintenance Diagnostic Equipment (TMDE), Training, Equipment publications, Retail level inventory, Wholesale level inventory, National Stock Numbers (NSN's), and Facility requirements.

DIRECT AND INDIRECT COSTS



OVERLAPPING SECTION INCLUDES ELEMENTS COVERED BY FACTORS AND NOT SPECIFICALLY IDENTIFIED

FIGURE 5-1. LOGISTICS ASSESSMENT COSTS

5.6.2 Summary of Findings.

The total logistics savings from the elimination of the LMTV fleet are estimated to be $68 million. These savings are off-set by a cost increase from $255 million to $268 million due to an increase in retail and wholesale inventory due to the increased number of MTV in the fleet. Therefore, the elimination of the LMTV from the FMTV family causes a probable cost increase of $187 million to $200 million. When this value is compared to the $20 billion associated with the FMTV fleet, the summary conclusion is that no significant logistics impacts are discovered as a result of the elimination of the LMTV from the FMTV family.

The lack of significant findings is explained by two factors. The LMTV is one member of a family of vehicles designed to incorporate the benefits of commonality. Thus, fewer elements of the program are eliminated than might have been expected. Also, the LMTV is replaced in most cases with a more expensive MTV. Thus logistics costs increase in most cases. Table 5-6 summarizes the findings in this analysis which are discussed in greater detail in the following subsections.

TABLE 5-6. LOGISTICS ASSESSMENT SUMMARY
(FY90 CONSTANT DOLLARS IN MILLIONS)

ELEMENT	COST		SAVINGS	
	ANNUAL	ONE TIME	ANNUAL	ONE TIME
1. SP. TOOLS	$0	$0	$0	$0
2. TRAINING	$0	$0	$0	$0
3. PUBS	*	$0	*	$1
4. NSN				
ESTABLISH	$0	$0	$0	$0 to $3
MAINTAIN	$0	$0	**	$0
5. RETAIL				
INVENTORY	$0	$48 to $50	$0	$19
6. WHOLESALE				
INVENTORY	$0	$207 to $216	$0	$49
7. FACILITIES	$0	$0	$0	$0
TOTAL IMPACT	$0	$255 to $268	$0	$68

* Directly accounted for in the LCC
** Less than $1 million over ten years

5.6.3 Detailed Analysis.

The detailed analysis of each of the seven logistic areas is presented in the following paragraphs.

5.6.3.1 Special Tools/TMDE. Special tools used in the performance of maintenance are purchased as secondary items along with repair parts and are stored at the unit level secondary item inventory. Data obtained from TACOM (AMSTA-MTB) indicates that there will be no cost impact resulting from special tools/test equipment category upon elimination of the LMTV vehicles. The findings for this assumption is based on preliminary data within the FMTV Integrated Logistics Support Plan which indicates that no special tools or test equipment, not presently in the army inventory, will be required to support the FMTV family of vehicles. Therefore there is no projected cost or savings associated with the elimination of the LMTV for this logistics element.

5.6.3.2 Training. The cost impact on training for the FMTV program was discussed with TACOM (AMSTA-MLT). Preliminary information indicates that there will be no training cost impact upon elimination of the LMTV vehicles. Due to the high degree of commonality anticipated between the LMTV and MTV, TACOM plans to implement training for both vehicles during one class. There are no plans to conduct any specific LMTV training courses. TACOM will conduct FMTV New Equipment Training Classes at TACOM for Army personnel, who will in turn disseminate training information to TRADOC, and the unit level. No significant impacts are anticipated to the Advanced Individual Training (AIT) course dedicated to training enlisted personnel in the MOS 63B Wheeled Vehicle Mechanic Course. Therefore there is no projected cost or savings associated with the elimination of the LMTV for this logistics element.

5.6.3.3 Equipment Publications. There are two categories of equipment publications for the FMTV program. They are warranty technical bulletins and technical manuals.

Warranty Technical Bulletins (WTB) cover those major end items with manufacturer's warranty, such as engines, transmissions, etc. There are approximately 12 to 18 items common to both the LMTV and MTV vehicles which will be warranted. No measurable impact can be identified at this time.

Technical manuals are further subdivided into Lubrication Order manuals (the same manual is used for the LMTV and MTV), Operator manuals (one per LMTV and one per MTV), Maintenance manuals (one manual in two volumes per LMTV and one per MTV), and Parts manuals (one manual in two volumes per LMTV and one per MTV).

Information received from AMSTA-MTB suggests the following impacts on equipment publications. The Lubrication Order manuals are not specific to either manual. Therefore no cost impact is identified. The Operator manuals are vehicle specific and are approximately 200 pages in length. Elimination of the LMTV Operators manual causes a one time savings of $90,000 (200 pages times $450 per page). This savings reflects the one time, nonrecurring setup cost of printing and reproduction of the manual. The manual is issued with the vehicle and costs for this manual are included in the UPC used in the LCC analysis.

The Maintenance manuals are vehicle specific. The LMTV Maintenance manual is in two volumes at approximately 500 pages each. The cost savings for 1,000 pages at $450 per page is $450,000. This savings reflects the one time, nonrecurring setup cost of printing and reproduction of the maintenance manual. Once again, the Maintenance manual is issued with the vehicle and costs for this manual are included in the UPC used in the LCC analysis.

Parts manuals are also vehicle specific. The LMTV Parts manual is in two volumes at approximately 500 pages each. The cost savings for 1,000 pages at $450 per page is $450,000. This savings reflects the one time, nonrecurring setup cost of printing and reproduction of the parts manual. Similar to the maintenance manuals, the Parts manual is issued with the vehicle and costs for this manual are included in the UPC used in the LCC analysis.

The total Equipment Publications logistics impact is the sum of the Warranty Technical Bulletin and the Technical Manuals. The total one time cost savings is $990,000 or $0.99 million.

5.6.3.4 National Stock Number (NSN) Analysis. The focus of the analysis on NSN's is to estimate the cost impact (negative or positive) to establish a new NSN and the annual cost to maintain an NSN. The cost to establish a NSN will be discussed first.

A preliminary estimate from TACOM (AMSTA-MTB) for the total number of NSN's required by the FMTV program is 13,000. A highly probable breakdown of these 13,000 NSN's into components is outlined below. The analysis uses the information obtained from this breakout in order to estimate those costs for the establishment and maintenance of LMTV unique NSN's which would be directly affected by a decision not to procure the LMTV.

Breakout:

9,000 NSN's are estimated to be "New" NSN line item introductions.

4,000 NSN's are estimated to be existing items currently established and maintained by TACOM.

TACOM (AMSTA-MTB) estimates that of a total of 13,000 total NSN's required for the FMTV family of vehicles, approximately 4,000 NSN's are already established, part of existing vehicle systems, and therefore excluded from our analysis.

At present there is no breakout of NSN line items by LMTV family and MTV family. However, there is preliminary data from each contractor engaged in prototype development that the cargo model of the LMTV and MTV vehicle class, will share approximately eighty (80) to ninety-five (95) percent commonality in NSN line items, with the remainder being unique parts. This analysis assumes that these unique parts are divided equally between the LMTV and MTV. The majority of trucks purchased under the FMTV program fill a role required by the cargo variant in the 2 1/2-ton and 5-ton weight class. Given this approximation, it is possible to develop cost estimates for a range of unique LMTV NSN line items and postulate a potential savings commensurate with not introducing the LMTV vehicles.

Table 5-7 shows the derivation of unique LMTV NSN's based on a range of percentages for "common" parts.

TABLE 5-7. FMTV PARTS ANALYSIS
% Common

	If	80%	85%	90%	95%
Total New FMTV NSN's	9000	7200	7650	8100	8550
# UNIQUE		1800	1350	900	450
LMTV NSN's (1/2 of total)		900	675	450	225

Assuming a figure of 80% commonality in NSN line items between the LMTV and the MTV, a decision not to procure the LMTV eliminates the need to establish and maintain 900 unique NSN's. This implies savings in the Wholesale inventory which is responsible for managing (establishing and maintaining) each NSN.

Establishing an NSN. Data from TACOM(AMSTA-MTB) for the one time cost to establish an NSN was used in conjunction with the possible range of unique LMTV NSN's to derive a range of savings. By eliminating the LMTV these unique NSN's would not have to be established; thus a savings is incurred.

The cost to establish a single NSN in FY90 constant dollars is $1,844 to $3,300. Table 5-8 provides the savings associated with each range of unique LMTV NSN's.

TABLE 5-8. SAVINGS FROM ESTABLISHING NEW NSN
Unique

LMTV NSN's	Cost per NSN	Potential savings (M$)
900	$1,844 to $3,300	$1.659 to $2.970
675	$1,844 to $3,300	$1.245 to $2.228
450	$1,844 to $3,300	$0.830 to $1.485
225	$1,844 to $3,300	$0.415 to $0.743

Thus, the savings associated with eliminating the LMTV varies from $0.415 million to $2.979 million.

Maintaining an NSN. The wholesale inventory manages parts which are of significant complexity and dollar value to warrant the performance of maintenance action at the Depot level. Estimates on the quantity and type of repairable items to be carried at the wholesale level, for the FMTV program, are for 12 to 18 major items, such as engines, transmissions and differentials.

Annual Savings are defined to be those resources not expended to maintain a certain number of unique LMTV NSN's the wholesale inventory accounting system.

TACOM (AMSTA-MTB) provided the following data to estimate the annual cost of maintaining a certain number of NSN's in the wholesale inventory.

$16.00/hour = average cost to maintain an NSN
1.5 hours/NSN = hours to maintain an NSN
110% = overhead factor (TACOM related)

The mathematical expression for the annual cost per line item is:

Annual Cost = (# of lines)(1.5)($16.00)(1.10)

Using the estimate of 900 unique LMTV NSN's which would not have to be maintained, and this formula, we can estimate the annual savings in the Wholesale inventory as follows;

(900)(1.5)($16.00)(1.1) = $23,760 Annual savings for 900 NSN's.

The above formula used in conjunction with a range of possible number of unique LMTV NSN's generates the cost projections for annual savings presented on Table 5-9.

TABLE 5-9. FMTV PARTS ANALYSIS
% Common

		80%	85%	90%	95%
Total New FMTV NSNs	9000	7200	7650	8100	8550
# UNIQUE		1800	1350	900	450
LMTV NSN's (1/2 of total)		900	675	450	225
SAVINGS		$23,760	$17,832	$11,88	$5,940

When taken over ten years,the average savings varies from $0.059 million to $0.237 million.

5.6.3.5 Retail Level Inventory. At this point in the FMTV acquisition process there is no exact method of determining the quantity of provisioning parts to be carried at the retail level. A determination of this quantity depends on which contractor is selected for production and the final configuration as described by the Prescribed Load List (PLL) of all vehicles. The PLL is a listing of all provisioning items associated with the fielding of a new vehicle. Final definition of the FMTV PLL will occur approximately 240 days after contract award. At this time, the exact number of provisioning parts required at the retail level will be determined. Consequently, a methodology was developed to determine the expected savings and costs in retail inventory as a result of eliminating the LMTV family of vehicles.

The methodology makes two important assumptions. First, a direct relationship exists between a vehicle's cost and the value of the retail inventory for that truck. Secondly, there is comparable complexity between the 2 1/2-ton and 5-ton truck. The estimate represents the cost to procure, store and maintain the spare and repair parts held in retail inventory for an average 2 1/2-ton and 5-ton truck.

Historic cost data used in this analysis comes from a 1984 Army Materiel System Analysis Agency (AMSAA) study entitled "Cost Implications On Previously Unexplained Areas Of Logistic Support Caused By Replacing 2 1/2 Ton With 5 Ton Trucks". The basic data is summarized below.

$51,240 (FY84C$) = Weighted unit price of 2 1/2-ton cargo truck
$69,280 (FY84C$) = Weighted unit price of 5-ton cargo truck
$512.00 (FY84C$) = 2 1/2-ton truck average retail inventory cost
$1,390.00 (FY84C$) = 5-ton truck average retail inventory cost

The data, normalized to FY90 constant dollars is presented below.

$62,134 (FY90C$) = Weighted unit price of 2 1/2-ton cargo truck
$84,009 (FY90C$) = Weighted unit price of 5-ton cargo truck
$621.00 (FY90C$) = 2 1/2-ton truck average retail inventory cost
$1,686 (FY90C$) = 5-ton truck average retail inventory cost
$61,359 (FY90C$) LMTV average unit procurement price
$83,698 (FY90C$) MTV average unit procurement price

A ratio was established to estimate the logistics impact of elimination of the LMTV and increase in the MTV quantity.

LMTV cost/2 1/2-ton cost = X/2 1/2-ton average retail cost
MTV cost/5-ton cost = X/5-ton average retail cost

The results are:

LMTV [($61,359/$62,134) = (X/$621)] Answer: X=$613/truck
MTV [($83,698/$84,009) = (X/$1,686)] Answer: X=$1.650/truck

The LMTV per vehicle retail inventory cost is applied to the number of LMTV vehicles eliminated to estimate the retail inventory savings. Likewise, the

MTV per vehicle retail inventory cost is applied to the quantity of additional MTV vehicles. The data are presented for each alternative.

ALTERNATIVE I: TWVRMO ALTERNATIVE
MTV TOTAL INCREASED RETAIL COSTS: $1,650 X 30,467 = $50,270,550
LMTV: TOTAL RETAIL SAVINGS: $613 X 30467 = $18,676,271

ALTERNATIVE II: SAIC "LIGHT"
MTV TOTAL INCREASED RETAIL COSTS: $1,650 X 29,104 = $48,021,600
LMTV: TOTAL RETAIL SAVINGS: $613 X 30467 = $13,676,271

ALTERNATIVE III: SAIC "HEAVY CONSOLIDATED"
MTV TOTAL INCREASED RETAIL COSTS: $1,650 X 30417 = $50,188,050
LMTV: TOTAL RETAIL SAVINGS: $613 X 30467 = $18,676,271

ALTERNATIVE IV: SAIC "LIGHT CONSOLIDATED"
MTV TOTAL INCREASED RETAIL COSTS: $1,650 X 29,054 = $47,939,100
LMTV: TOTAL RETAIL SAVINGS: $613 X 30467 = $18,676,271

ALTERNATIVE V: SENSITIVITY - SAIC "LIGHT CONSOLIDATED ALT W/ 5/4 TON TRAILER"
MTV TOTAL INCREASED RETAIL COSTS: $1,650 X 29,054 = $47,939,100
LMTV: TOTAL RETAIL SAVINGS: $613 X 30467 = $18,676,271

ALTERNATIVE VI: SENSITIVITY - SAIC "LIGHT CONSOLIDATED ALT. W/ 5/4 TON TRAILER"
MTV TOTAL INCREASED RETAIL COSTS: $1,650 X 29,054 = $47,939,100
LMTV: TOTAL RETAIL SAVINGS: $613 X 30467 = $18,676,271

The one time cost increase associated with retail level inventory varies from $47.939 million to $50.270 million. The one time savings due to elimination of the LMTV is $18.676 million.

5.6.3.6 Wholesale Level Inventory. The analysis to estimate the annual cost impact upon the wholesale inventory uses the same methodology as in the retail inventory analysis. Therefore, only the data and expressions used to determine the wholesale inventory cost impact are presented.

The cost data used in this analysis comes from a 1984 AMSAA study entitled "Cost Implications On Previously Unexplained Areas Of Logistic Support Caused By Replacing 2 1/2 Ton With 5 Ton Trucks". The basic data are presented below.

$51,240 (FY84C$) = Weighted unit price of 2 1/2-ton cargo truck
$69,280 (FY84C$) = Weighted unit price of 5-ton cargo truck
$1,350 (FY83C$) = 2 1/2-ton truck average wholesale inventory cost
$5,925 (FY83C$) = 5-ton truck average wholesale inventory cost

This data was normalized to FY90 constant dollars.

$62,134 (FY90C$) = Weighted unit price of 2 1/2-ton cargo truck
$84,009 (FY90C$) = Weighted unit price of 5-ton cargo truck
$1,637 (FY90C$) = 2 1/2-ton truck average retail inventory cost
$7,185 (FY90C$) = 5-ton truck average retail inventory cost
$61,351 (FY90C$) LMTV average unit procurement price
$83,698 (FY 90C$) MTV average unit procurement price

A ratio was established to estimate the logistics impact of elimination of the LMTV and increase in the MTV quantity.

LMTV cost/2 1/2-ton cost = X/2 1/2-ton average wholesale cost
MTV cost/5-ton cost = X/5-ton average wholesale cost

The results are presented below.

LMTV [(61,351/$62,134) = (X/$1,637)] Answer: X=$1,616/truck
MTV [(83,698/$84,009) = (X/$7,185)] Answer: X=$7,158/truck

The LMTV per vehicle wholesale inventory cost for spare and repair parts will be applied to the number of LMTV vehicles eliminated to estimate the wholesale inventory savings. Likewise, the MTV per vehicle wholesale inventory cost for spare and repair parts will be applied to the quantity of additional MTV vehicles.

ALTERNATIVE I: TWVRMO ALTERNATIVE
MTV TOTAL INCREASED WHOLESALE COSTS: $7,158 X 30,467 = $218,082,786
LMTV: TOTAL WHOLESALE SAVINGS: $1,616 X 30467 = $49,234,672

ALTERNATIVE II: SAIC "LIGHT"
MTV TOTAL INCREASED WHOLESALE COSTS: $7,158 X 29,104 = $208,326,432
LMTV: TOTAL WHOLESALE SAVINGS: $1,616 X 30467 = $49,234,672

ALTERNATIVE III: SAIC "HEAVY CONSOLIDATED"
MTV TOTAL INCREASED WHOLESALE COSTS: $7,158 X 30417 = $217,724,886
LMTV: TOTAL WHOLESALE SAVINGS: $1,616 X 30467 = $49,234,672

ALTERNATIVE IV: SAIC "LIGHT CONSOLIDATED"
MTV TOTAL INCREASED WHOLESALE COSTS: $7,158 X 29,054 = $207,968,532
LMTV: TOTAL WHOLESALE SAVINGS: $1,616 X 30467 = $49,234,672

ALTERNATIVE V: SENSITIVITY - SAIC "LIGHT CONSOLIDATED ALT. W/ 5/4-TON TRAILER"
MTV TOTAL INCREASED WHOLESALE COSTS: $7,353 X 29,054 = $207,968,532
LMTV: TOTAL WHOLESALE SAVINGS: $1,616 X 30467 = $49,234,672

ALTERNATIVE VI: SENSITIVITY - SAIC "LIGHT CONSOLIDATED ALT. W/ 5/4-TON TRAILER"
MTV TOTAL INCREASED WHOLESALE COSTS: $7,353 X 29,054 = $207,968,532
LMTV: TOTAL WHOLESALE SAVINGS: $1,616 X 30467 = $49,234,672

The one time cost increase associated with wholesale level inventory due to increasing the number of MTV in the fleet varies from $207.968 million to $218.082 million. The one time savings due to elimination of the LMTV is $49.234 million.

5.6.3.7 Facility Requirements. Facility requirements are those buildings and storage spaces which function to support training, operational activities, maintenance activities, supply/support activities, and any special consideration. The FMTV program as it is currently defined has no requirements for an facilities which are presently not available to the FMTV end user. This absence of facility requirements is documented in the current FMTV ILSP dated JAN 8, "Support Facilities Annex", p. 4. Therefore, there is no projected cost or savings associated with the elimination of the LMTV for this logistics element.

SECTION 6
SUMMARY OF ANALYSIS

This section summarizes the advantages and disadvantages of each fleet in terms of the fleet cost estimates presented in Section 3 and the fleet characteristics presented in Section 4. The costs and fleet characteristics of the baseline and each of the four primary alternatives are presented in Table 6-1 in terms of the percent change from the Baseline Fleet.

TABLE 6-1. PERCENT CHANGE FROM THE BASELINE FLEET

ALTERNATIVE	COST*	WEIGHT	CUBE	SORTIES* (ABN DIV)	MOBILITY	TRANSPORT-ABILITY	MAN-POWER*
BASELINE	-	-	-	-	-	-	-
1. TWVRMO (HVY)	5.8	27.5	5.4	26.4	@	-	3.3
2. LIGHT	5.5	24.8	5.0	20.8	@	4.8	3.7
3. HEAVY-CONSO	5.8	27.4	5.3	23.2	@	-	3.3
4. LIGHT-CONSO	5.5	24.7	4.9	17.6	@	4.8	3.7

* Indicates factors in which increases are unfavorable
@ Specific measures of mobility were not calculated

Clearly, for some of the fleet characteristics, increases are an advantage and for others increases are a disadvantage. Table 6-2, using + for an advantage and - for a disadvantage, provides another way to compare the alternatives and discuss the merits of each.

From Tables 6-1 and 6-2 and the analyses which has been presented, the following observations can be made.

TABLE 6-2. ADVANTAGES AND DISADVANTAGES OF FLEET ALTERNATIVES

ALTERNATIVE	COST	WEIGHT	CUBE	SORTIES	MOBILITY	TRANSPORT-ABILITY	MAN-POWER
BASELINE	o	o	o	o	o	o	o
1. TWVRMO (HVY)	-	+	+	-	+	o	-
2. LIGHT	-	+	+	-	+	+	-
3. HEAVY-CONSO	-	+	+	-	+	o	-
4. LIGHT-CONSO	-	+	+	-	+	+	-

\+ Advantage - Disadvantage o No Change

The costs of the alternatives are shown as being about 5.5% greater than the Baseline Fleet. However, as indicated in Section 3-2, the cost estimates are only considered to be accurate to within a plus or minus 10%. Therefore, cost differences between the alternative fleets are not statistically significant. However, when considering the LMTV alone and comparing its cost with that of the LMTV alternatives, it was shown that this is about a 20% cost increase for each of the alternatives. Further, it was shown that each of the alternatives requires about $30M more in operating costs than the Baseline.

Weight and cube capability of each -e alternatives are significantly greater than the Baseline Fleet. However, as pointed out in Section 4-1, the Baseline Fleet is currently capable of performing its cargo hauling mission and the weight and cube increase inherent in the alternatives represents capacity which would not appear to be required. An assessment of this added payload capability was beyond the scope of this study.

Base upon results of a study done concurrently with this study by the Waterways Experimant Station (WES), each of the alternatives offers mobility enhancements when compared to the Baseline Fleet. This is because the substitutions in each alternative are preponderantly the MTV with trailer for the LMTV with trailer. The CUCVs and HMMWVs in Alternatives 2 and 4 are less mobile than the LMTV; therefore these two alternatives are less mobile than Alternatives 1 and 3. However, since there are so few CUCVs and HMMWVs in the two alternatives (less than 3%), mobility of these fleets should exceed that of the Baseline. An assessment of the impact of mobility on mission capability was beyond the scope of this analysis.

Turning next to transportability, Alternatives 2 and 4 offer minimal enhancement over the Baseline Fleet in that the 5/4-ton members of the fleet can be transported by UH-60 helicopter. However, there are only modest numbers of 5/4-ton trucks in the two alternative fleets, and, as presented in Section 4-4, the 5/4-ton trucks are substituting for LMTV vehicles which can not be transported by UH-60 and for which a UH-60 helicopter lift requirement does not exist.

Finally, when compared to the Baseline Fleet, all four alternatives require more sorties for strategic deployability and require additional manpower.

Thus, while it is feasible to replace the LMTV variant in the FMTV family with 5/4-ton and 5-ton trucks and associated trailers, no compelling rationale exists to support such a move. Further, the intangible cost to the Army of such a move should be considered. The implementation of such a course of action would change the familiar way the Army has operated for decades and would force the redefinition of load plans and operating procedures for nearly every unit in the Army, with attendant near term impacts on readiness and training.

SECTION 7

CONCLUSIONS AND RECOMMENDATIONS

7.1 CONCLUSIONS

The analysis has led to the following conclusions.

- It is feasible to eliminate the LMTV variant from the FMTV fleet by substituting 5/4-ton and MTV trucks and associated trailers.
- Because the LMTV mission and capability are well matched the preponderance of substitutions required an MTV; there were few opportunities to substitute smaller, less expensive vehicles. Thus, within the scope of the analysis, no alternatives exist which are less costly than the Baseline Fleet with equal capability.
- Several fleet alternatives exist with life cycle costs about 5.5% greater than the Baseline Fleet. These fleet alternatives have greater weight and cube capability (an assessment of the utility of this added payload capability was beyond the scope of this analysis) and somewhat enhanced mobility when compared with the Baseline Fleet.
- Each of the feasible alternatives identified has shortcomings in the important areas of strategic deployability and personnel requirements.
- Each alternative fleet, when fully fielded, will increase sustainment costs about $30M per year when compared with the Baseline Fleet.
- Based on the factors considered in this analysis, no compelling rationale exists for the elimination of the LMTV variant from the FMTV family.

7.2 RECOMMENDATION

- The 2 1/2-ton truck should be retained in the Army force structure.

ANNEX A

STATEMENT OF WORK

1. Class of Analysis: Force Structure Studies

2. Title: A Study of the Feasibility of Eliminating the 2 1/2 Ton Payload Truck Class

3. Contract: MDA 903-88-D-1000

4. Background

The US Army has initiated a program entitled the Family of Medium Tactical Vehicles (FMTV), consisting of 2 1/2 ton and a 5 ton payload trucks. The question has been raised as to whether this mix is the most cost effective program to provide the required movement assets. Specifically, the Army wishes to determine whether a mix of 5/4 ton and 5 ton payload trucks with associated trailers is a more cost effective program than the proposed FMTV. The study to be performed by the contractor will provide the information necessary to answer this question.

5. Task Statement

The contractor will conduct a study of the feasibility of alternative mixes of 5/4 ton and 5 ton trucks with associated trailers that will provide (without a 2 1/2 ton variant):

(a) increased capability (with respect to the propcsed FMTV Program) at a comparable cost, and,

(b) capability comparable to that provided by the proposed FMTV Program at less cost.

In addition, the contractor will estimate the potential manpower and operating cost implications of removing one class of vehicle, (i.e., the 2 1/2 ton truck) from the current fleet.

6. Scope

This study will be based on the current Army force structure as defined in the Force Accounting System and Total Army Analysis and on current TOE unit missions. The study will evaluate mixes of trucks and associated trailers which are currently in the Army inventory, the FMTV 5 ton truck, and appropriate trailers associated with the 5 ton and the 5/4 ton trucks.

In estimating alternative costs, MTOE and TDA requirements will be added to TOE and BOIP requirements.

Results will be presented in terms of alternative mixes of trucks and trailers, mission shortfalls associated with each alternative, and personnel and financial costs associated with each alternative. At the minimum and to the extent feasible, an equal cost and an equal capability (with respect to the FMTV program) alternative will be developed and presented.

Tasks

The execution of this study will include but is not limited to the following tasks:

(a) for TOE Units, determine payload and mission tasks currently performed by 2 1/2 ton trucks,

(b) identify truck/trailer characteristics required for successful accomplishment of each mission, including deployability and mobility requirements,

(c) develop aggregate unit truck requirements based on mission and payload requirements,

(d) determine minimum cost mix of 5/4 ton and 5 ton trucks and associated trailers which will meet requirements currently fulfilled by 2 1/2 ton trucks if a feasible mix exists, otherwise determine the mix which most nearly meets requirements,

(e) estimate the life cycle acquisition, operation and support costs for each alternative mix based on usage, personnel, transportation, maintenance, and support requirements,

(f) present the results of the analysis in a format suitable for use in making a cost/performance comparison of the alternatives considered.

7. Government Furnished Data

The Government will furnish the following documents which contain information which may be useful in the conduct of the study:

(a) "Elimination Explications Analysis of the 2 1/2 ton Tactical Truck", US Training and Doctrine Command, Tactical Wheeled Vehicle Requirements Management Office, Fort Eustis, Virginia 23504, dated March 1988.

(b) "Tactical Wheeled Vehicle Fleet Requirements - Final Report", Volume I: Executive Summary- Phase I, US Army Training and Doctrine Command, US Army Logistics Center, Fort Lee, Virginia 23801, and US Army Transportation School, Fort Eustis, Virginia 23604, dated October 1980.

(c) "Tactical Wheeled Vehicle Fleet Requirements - Final Report", Volume II: Main Report - Phase I, US Army Training and Doctrine Command, US Army Logistics Center, Fort Lee, Virginia

23801, and US Army Transportation School, Fort Eustis, Virginia 23604, dated October 1980.

(d) "Revalidation of the 1980 Tactical Wheeled Vehicle Requirements Study as it Pertains to Payload Requirements within the 1 1/4 to 5 ton Range (Short Title: REVAL 80) - Final Draft, Main Report", US Army Training and Doctrine Command, Tactical Wheeled Vehicle Requirements Management Office, Fort Eustis, Virginia 23504, dated December 1983.

(e) TWV Requirements Management Rationale Analysis of 2 1/2 Ton Vehicles, USALOGC, May 1981.

(f) Vehicle Support for Tactical Communication/Automation Systems (Short Title: Overload Study), USALOGC, March 1982.

(g) Life Cycle Cost Comparison of 2 1/2 Ton, 5 Ton, and MMW Vehicles, TACOM, June 1981.

(h) Logistics Implications of Replacing 2 1/2 Ton with 5 Ton Trucks, AMSAA, Logistics Study Office, August 1983.

(i) MTT138, M35A2, and M813A1 Mobility Data, Waterways Experiment Station, 15 Sep 1983

(j) Revelent output from AALPS Model to compare air deployability of notional and current inventory vehicles.

(k) Relevent output of the LOGSACS model to define the notional and current inventory vehicles needed to equip the units in the force structure.

(l) Access to the TWV Data Base, resident at the TWVRMO, USALOGC, to support specific analytical efforts.

(m) OSDDRE&E Memorandum, SUBJ: Conventional Systems Committee Review of the FMTV Program, 6 April 1988.

(n) O&O Plan for FMTV, 24 Sep 84.

(o) JSOR for FMTV, 10 Nov 87.

(p) TB 55-46-1, Standard Characteristics for Transportability of Military Vehicles and Other Outsized/Overweight Equipment, HQDA, 1 Jan 88.

(q) Draft US Army Wheeled Vehicle Master Plan, HQDA, April 1988.

(r) BOIP, FMTV

8. Deliverables

Results of this task will be required eight months after task order award. The contractor will deliver a technical report describing the analysis methodologies and data used in the study and the results of the analysis. The results will be presented in terms of the alternatives identified, the performance measures and cost estimates for each alternative, and other non-quantifiable operational implications of any alternative. Sensitivity analyses should be presented to show the effects of variations in mission and payload requirements and deployability on the cost and performance estimates for each alternative mix presented.

A written study plan and schedule will be delivered within 15 days of contract award. Bimonthly written and oral progress reports will be presented throughout the expected eight months of the study effort.

Three copies of the draft final report along with briefing material (vu-graphs) will be delivered three weeks prior to final delivery date.

Six copies of the final report and final briefing materials will be provided.

9. Agency Support

(a) Contracting Officer's Representative is Mr. Eugene P. Visco, Director, Study Program Management Agency, Office of the Deputy Under Secretary of the Army (Operations Research), Attn: SAUS-SPM, Room 3C567, Pentagon, Washington, DC 20310-0102, telephone (202) 697-0026.

(b) The Technical Representative for this task is Dr. Robert G. Hinkle, Office of the Deputy Under Secretary of the Army (Operations Research), Attn: SAUS-OR, Room 1E643, Pentagon, Washington, DC 20310-0102, telephone (202) 697-1175.

ANNEX B

OPERATIONAL ANALYSIS DETAIL

The purpose of this annex is to provide a more detailed description of the operational analysis which produced the fleet alternatives presented in Section 3 of this report. An overview of the operational analysis methodology was provided in Section 2.1 while results of the operational analysis were presented in Section 3.1. This annex is organized in four appendices, each of which addresses one of the four primary tasks highlighted in Figure B-1.

Appendix I	Vehicle Requirements and Missions
Appendix II	Substitution Analysis
Appendix III	Baseline and Alternative Fleets
Appendix IV	Fleet Characteristics - Deployability

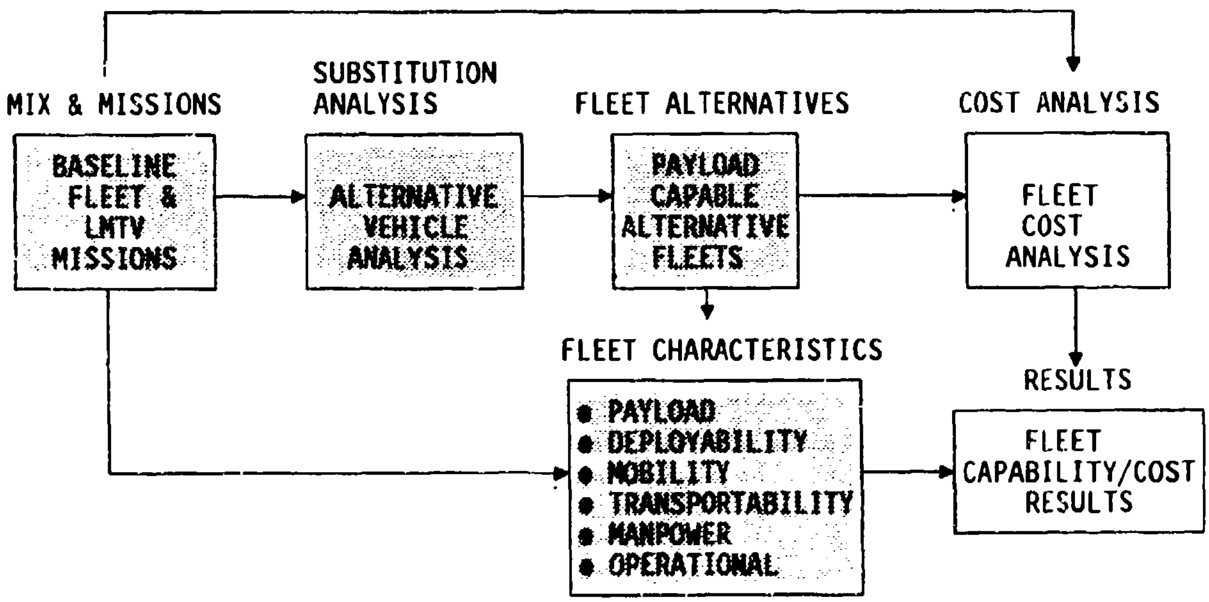


FIGURE B-1. OPERATIONAL ANALYSIS TASKS

APPENDIX I

to

ANNEX B

VEHICLE REQUIREMENTS AND MISSIONS

1 STUDY GUIDANCE

The Statement of Work at Annex A states "This study will be based on the current Army force structure as defined in the Force Accounting System and Total Army Analysis and on current TOE unit missions." Force Accounting System data describing the FY97 Objective Force, with the FMTV Basis of Issue Plan (BOIP) applied, was gathered as the basis for the vehicle fleets to be used in the study. Since, however, this data did not reflect the Army's recent effort to develop and implement a Tactical Wheeled Vehicle (TWV) Modernization Plan, the Study Advisory Group, at its 6 December 1988 meeting, instructed the study team to use requirements stated in the Modernization Plan for fleet development and costing. By the February meeting of the SAG, however, it had become apparent that the Modernization Plan requirements for LMTVs and MTVs would not be procured within the period of time covered by the study. The study team was therefore directed to use the Modernization Plan Procurement Strategy objectives for FMTV trucks as the basis for the development and costing of baseline and alternative vehicle fleets.

2 VEHICLE REQUIREMENTS

As directed by the SAG, the vehicle requirements in the Baseline Fleet are for 30,467 LMTVs and 67,413 MTVs in accordance with the Modernization Plan Procurement Strategy. These numbers, however, because they were derived by the Army staff based upon current and projected fiscal constraints over the period 1991 to 2020, are not necessarily representative of the actual mix of LMTVs and MTVs which may be required to support the currently projected Army force structure if it were fully equipped with LMTVs and MTVs. For this reason, the first two tasks of the operational analysis, mainly the identification of vehicle requirements and missions and the substitution of alternate sets of vehicles to accomplish the LTMV missions, were completed based upon the the original guidance to use the "current Army force structure as defined in the Force Accounting System ...". Once this requirements based analysis was completed, the results were used to complete the final two operational analysis tasks, mainly the development of alternative vehicle fleets and the evaluation of alternative fleet characteristics, scaled to the Procurement Strategy objectives of 30,467 LMTVs and 67,413 MTVs.

The Force Development Support Agency (FDSA) provided data extracts based upon August 1988 data from the Logistics Structure and Accounting System (LOGSACS) so that the study team could identify Initial Issue Quantity (IIQ) plus POMCUS requirements for selected trucks and trailers in the FY97 Objective Force. These requirements, reflecting the then current but unapproved FMTV BIOP, are shown in Table B-I-1.

TABLE B-I-1. FY97 OBJECTIVE FORCE IIQ + POMCUS REQUIREMENTS

VEHICLE	IIQ + POMCUS
2 1/2-TON TRUCK	65,098
5-TON TRUCK	62,348
1 1/2-TON TRAILER	58,063
2 1/2-TON TRAILER	17,728
5-TON TRAILER	1,351

Vehicles were identified by component (Active, National Guard, Army Reserve, and POMCUS), organization, and variant (i.e., cargo, dump, wrecker, etc.). This data permitted the study team to select a subset of organizations, identified by Standard Reference Code (SRC), which would be representative of the organizations and missions of 2 1/2-ton trucks across the Army. Appendix II describes how this subset was selected and how the detailed analysis of vehicle missions was accomplished based upon these requirements.

Although Table B-I-1 does represent the current FY97 force structure requirements for the vehicles listed, it does not represent projected changes which will occur in those requirements as a consequence of the Tactical Wheeled Vehicle (TWV) Modernization Plan which was approved by the Army Chief of Staff in April, 1989. So that the cost analysis phase of this study might provide as accurate a picture of the cost implications of the potential elimination of the 2 1/2-ton class of trucks as possible, the SAG directed the study team to use the projected vehicle requirements as stated in the Modernization Plan. These numbers, provided by the TWVRMO, are shown in Table B-I-2.

TABLE B-I-2. TWV MODERNIZATION PLAN REQUIREMENTS

VEHICLE	TWV MOD PLAN
2 1/2-TON TRUCK	58,258
5-TON TRUCK	71,660
1 1/2-TON TRAILER	41,834
2 1/2-TON TRAILER	14,480
5-TON TRAILER	1,098

These numbers, while perhaps more accurately reflecting the requirements as they will exist once the LOGSACS data base is updated, could not have been used for the detailed analysis of vehicle missions because they were not yet identifiable by component, organization, or variant.

Unfortunately, the procurement of vehicles to satisfy these requirements is subject to fiscal constraints and the prioritization process resulting from those constraints. Thus the Army developed a TWV Modernization Plan Procurement Strategy in which the requirements for trucks shown in Table B-I-2 would be met by procuring a reduced number of new LMTVs and MTVs and by extending the useful life of the current fleet of 2 1/2-ton and 5-ton trucks thorough a Service Life Extension Program (SLEP). While monies were allocated in the procurement plan for the acqusition of trailers, the exact number of trailers was not specified.

As in the Modernization Plan itself, the component, organization, and variant of the vehicles in the procurement plan were not available for use in this study. Table B-I-3 shows the Procurement Strategy objectives.

TABLE B-I-3. TWV PROCUREMENT STRATEGY OBJECTIVES

VEHICLE	TWV MOD PLAN
2 1/2-TON TRUCK	30,467
5-TON TRUCK	67,413
1 1/2-TON TRAILER	?
2 1/2-TON TRAILER	?
5-TON TRAILER	?

As stated earlier, these are the numbers of LMTV and MTV trucks used to describe the Baseline Fleet of vehicles and upon which all alternative fleets were developed and costed. Because the number of trailers were not specifically identified and the variant distributions for the trucks were not specified, several calculations were made so that the Baseline and alternative fleets could be completely described.

- o The distribution of LMTV and MTV variants in the FMTV BOIP was applied to the 30,467 LMTVs and the 67,413 MTVs to produce the Baseline Fleet distrubutions of trucks by variant.
- o The ratio of total trailers to total trucks in the Modernization Plan (Table B-I-2) was maintained for the 97,880 trucks in the Procurement Plan. The distribution of trailers by class was maintained as per the Modernization Plan distribution.

The Baseline Fleet of vehicles resulting SAG guidance and the above calculations is shown in the BASE column of Table 3-1. No 5/4-ton trucks or associated trailers are included in the Baseline Fleet because, like all other vehicles which exist in the Army force structure, they have no direct impact upon the results of this study.

3 VEHICLE MISSIONS

The determination as to whether feasible sets of vehicles existed which could perform the mission of the LMTVs in the Army's FY97 Objective Force organizations was done at the individual vehicle level. The process by which individual vehicles were identified within the sections of those TOEs selected for detailed analysis is described in Appendix II to this Annex. Once individual vehicles were identified in each TOE section, vehicle missions were identified in terms of specific payloads, pintle loads, and secondary missions. This was accomplished with the assistance of TRADOC's TWVRMO, which provided TOE documentation to include detailed vehicle justifications where necessary.

APPENDIX II

to

ANNEX B

SUBSTITUTION ANALYSIS

1 SRC SUBSET SELECTION

Requirements for 2 1/2-ton trucks were identified in August LOGSACS dat in over 500 organizations, each with a distinct Standard Reference Code (SRC). Since detailed analysis of vehicle requirements at the individual vehicle level within each of these organizations was beyond the scope of resources available for this study, it was necessary to select a subset of the SRCs upon which to conduct the detailled analysis. The subset was to be selected so that representative samples of vehicles could be examined across all Active Army, National Guard, Army Reserve, and POMCUS organizational structures and across all combat, combat support, and combat service support organizations. It was also desirable to include all divisional SRCs so that analysis of the impact of alternative fleets on the deployability of type divisions could be conducted.

The specific objectives in the selection of a subset of SRCs for detailed analysis were to maximize the number of vehicles analyzed while minimizing the number of SRCs analyzed and ensuring representative vehicle samples by vehicle type, component, branch, and division type. Fortunately this process of selecting a representative subset of SRCs was made easier by discovery of the fact that over 75% of the LMTV vehicles in the FY97 Objective force are in eight branches[1] and that over 70% of the vehicles are in only 125 SRCs. Each of the remaining 25 branches, one of which is a grouping of all TDA organizations, has less than 3% of all LMTVs. Based upon this information, a subset of 134 SRCs was proposed to the SAG at its meeting on 6 December, 1988, as an appropriately

[1] Branches in this case refers to a LOGSACS data base classification of organizations which parallels the common definition of branches but is not identical.

representative subset upon which to conduct detailed analysis of the missions of each LMTV. Figure B-II-1 indicates the percent coverage of key areas provided by this set of 134 SRCs.

LMTV TOTAL (% VEHICLES):	72
VEHICLE TYPE (% VEHICLES):	
CARGO	71
VAN	82
COMPONENT (% VEHICLES):	
ACTIVE	67
GUARD	74
RESERVE	65
POMCUS	85
BRANCH (% BRANCHES):	82
DIVISION (% TOEs):	
AIRBORNE	100
AIR ASSAULT	100
LIGHT	100
HEAVY	100

FIGURE B-II-1. SRC SUBSET COVERAGE

The 82% of the branches which included SRCs in the subset means that only 6 of the 33 branches did not provide any SRCs to the subset. These six branches possessed a total of only 1470 vehicles, of which 1302 were in TDA organizations. The eight branches which contained over 75% of the LMTV cargo vehicles are shown in Figure B-II-2 with the percent of the total vehicles which are in that branch and the percent of vehicles sampled within that branch.

BRANCH	% OF ALL LMTV CARGO VEH	% OF BRANCH VEH SAMPLED
FIELD ARTILLERY	15	61
INFANTRY	10	97
ARMOR	10	83
ENGINEERS	10	70
MAINTENANCE	9	91
COMBAT SERVICE SUPPORT	8	88
AVIATION	8	62
SIGNAL	5	50

FIGURE B-II-2. SUBSET COVERAGE OF KEY BRANCHES

The 134 SRC subset, which included 35,995 LMTVs, was considered to be appropriately representative of all LMTV missions and was approved by the SAG on 6 December, 1988, for use. The vehicle mission analysis explained in the remainder of this Appendix was conducted on the 260 TOEs which are subordinate to these 134 SRCs.

2 SUBSTITUTION METHODOLOGY DEVELOPMENT

Development of a vehicle substitution methodology involved the accomplishment of the three subtasks which are discussed in paragraphs 2.1 through 2.3.

2.1 Measures of Effectiveness.

Required vehicle capabilities, and hence relevant capability measures of effectiveness, are mission specific. While air deployability, cross-country mobility, or helicopter transportability may be required for a particular vehicle to accomplish a specific mission, all are not required of every 2 1/2-ton vehicle in the Army fleet. However, every vehicle in the fleet with a cargo hauling mission is required to possess sufficient payload capacity in terms of weight and cube to accomplish the assigned mission. Thus, for both individual vehicles and the fleet of vehicles the term "payload capable" was defined to mean that sufficient payload capability existed to carry all loads required as a part of either the vehicle or the units primary or secondary missions. This definition was used to determine the feasibility of alternative vehicles or sets of vehicles in the analysis of vehicles mission. Other capabilities such as deployability, mobility, and transportability were identified as characteristics of the fleet of vehicles to be addressed separately.

2.2 Alternative Vehicle Sets.

Study objectives specifically identified the set of alternative vehicles which could be considered as replacements for the LMTV as the current set of 5/4-ton trucks, the 5-ton MTV, and associated trailers. Thus, as indicated in Figure B-II-3, while the Baseline Fleet would have only LMTVs, MTVs, and their associated trailers, any feasible alternative fleets developed during the analysis would not include LMTVs but would only include some mix of MTVs, HMMWV cargo trucks, CUCV cargo trucks, and associated trailers.

Baseline Fleet trailers would therefore include some mix of the current 1 1/2-ton cargo trailer, the new 2 1/2-ton LMTV cargo trailer, and the new 5-ton MTV cargo trailer. Alternative fleets could include not only these but also the current 3/4-ton cargo trailer which is towed by the HMMWVs and CUCVs. Additionally, because the 3/4-ton trailer does not track properly with either the HMMWV or CUCV and therefore significantly degrades mobility, the SAG directed the study team to consider a notional 5/4-ton payload "high mobility" cargo trailer in the development of alternative vehicle fleets. The specific characteristics and capabilities of this trailer were to be provided to the study team by TACOM.

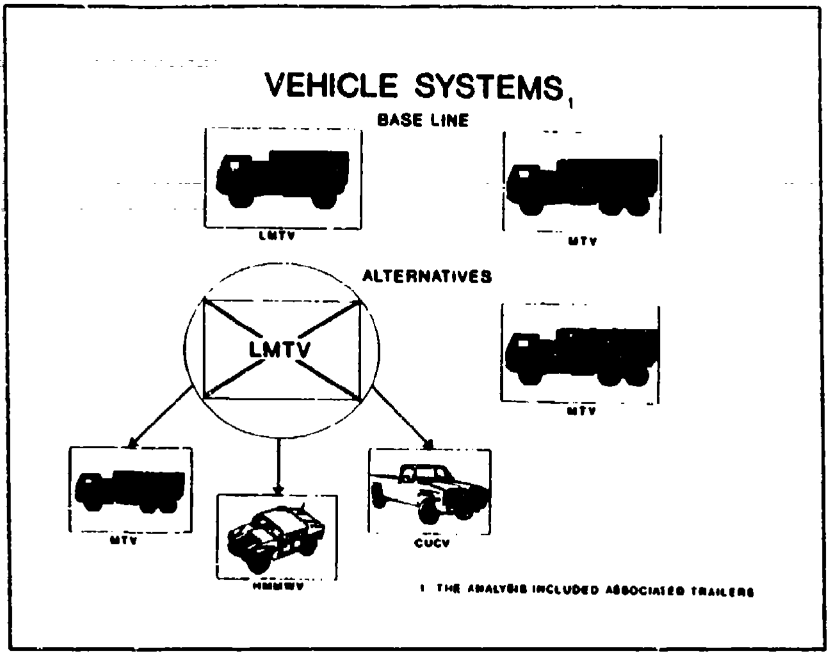


FIGURE B-II-3. ALTERNATIVE VEHICLE SYSTEMS

A key assumption which could not be violated during the substitution analysis was that all vehicles would be used only within their respective design specifications or known limitations. Since the measure of effectiveness used in the substitution analysis was payload capability, the payload capabilities of all potential substitute vehicles had to be determined ao that only feasible substitutions would be considered.

The capabilities of the LMTV and MTV, because the vehicles had not yet been built, were assumed to be as stated in the specifications under which the prototype vehicle- are being built. Capabilities of existing vehicles were taken from appropriate ay publications while TACOM provided data in the capabilities of the notional 5/4-ton trailer. Two situations in regard to vehicle capabilities had to be addressed before the HMMWV and the 5/4-ton trailer could be considered in the set of feasible substitute vehicles for the LMTV.

The HMMWV cargo truck, although classified as a 5/4-ton vehicle, has a usable payload weight of only 2100 pounds. In considering this truck as a substitute for an LMTV this constraint meant that two HMMWVs would not be sufficient to replace the LMTV, but that a trailer would have to be added to one of the HMMWVs or three HMMWVs would have to be used. This situation was discussed at a meeting with Mr. John Wright, the TRADOC System Manager (TSM) for the HMMWV, and TWVRMO personnel responsible for the review and approval of tactical wheeled vehicles in TOEs. The conclusion reached was that although the usable payload weight was in fact only 2100 pounds, many of the LMTV loads which might be considered for downsizing to one or more HMMWVs were not of sufficient weight to preclude the substitution of the smaller vehicles. It was further concluded that every load considered for downsizing would be checked for feasibility with the individual at TWVRMO responsible for that particular TOE and if necessary Mr. Wright would be consulted before a final decision on the feasibility of the substitution was made. This process was followed throughout the substitution analysis.

With regard to the notional 5/4-ton trailer for which TACOM was to provide specifications and capabilities, the payload weight capacity was determined to be only 2000 pounds. According to TACOM, the technology did not exist today to build a 5/4-ton payload capacity trailer within the towing capability of the existing HMMWV and CUCV fleets. Thus the notional 5/4-ton trailer was considered to be only a 1-ton trailer during the substitution analysis which produced the four primary alternative fleets. As a result of this capacity constraint, no situations were identified in any of the four primary alternatives in which this trailer would serve a useful function and thus no such trailers were included in the alternative fleets. However, because of the special interest in the impact of the availability of a 5/4-ton "high mobility"" trailer, an additional alternative fleet (Alternative 5) was developed and included in the cost analysis portion of the study. (See Appendix III to this Annex for a discussion of this situation.)

One final assumption was made in the process of identifying feasible alternative vehicles. This assumption had to do with the commercial nature of the CUCV versus the tactical LMTV. Because the CUCV lacks mobility capabilities which would make it a feasible substitute for an LMTV in some situations, it was decided that the CUCV should be considered a feasible substitute only in organizations which operated primarily behind the brigade rear boundary and which already had CUCVs in their list of authorized vehicles. This assumption was adhered to throughout the substitution analysis and was often the deciding factor in whether a HMMWV or a CUCV should be used to replace an LMTV in a particular situation.

The payload capacities of the study vehicles which were used during the substitution analysis, with appropriate caveats, are listed in Table B-II-1.

TABLE B-II-1. STUDY VEHICLE PAYLOAD CAPACITIES

VEHICLE	PAYLOAD WEIGHT (LBS)	PAYLOAD CUBE (FT)
LMTV CARGO	5000	405
MTV CARGO	10000	472
HMMWV CARGO	2100 *	190
CUCV CARGO	2500	184
3/4-TON TRAILER	1500	170
5/4-TON TRAILER	2000 **	176
"	2500 ***	176
1 1/2-TON TRAILER	3000	278
2 1/2-TON LMTV TRL	5000	405
5-TON MTV TRAILER	10000	472

* Acceptable substitute where approved by TWVRMO
** Alternatives 1 thru 4
*** Alternative 5

2.3 The Substitution Algorithm.

The Statement of Work at Annex A states that, ".. the Army wishes to determine whether a mix of 5/4-ton and 5-ton payload trucks with associated trailers is a more cost effective program than the proposed FMTV." Since it is generally more costly to procure and operate a larger vehicle than a smaller vehicle, it was important, from a cost persepctive, to maximize the number of 5/4-ton vehicles used to replace the LMTVs and to minimize the number of 5-ton vehicles in alternative fleets. A second obvious way to reduce the cost of alternative fleets was to take advantage of the increased payload capacity of the MTV and to reduce the total number of vehicles in the fleet through the consolidation of vehicle missions. Developing a methodology to achieve these objectives, e.g., downsizing the vehicles and consolidating loads, was the key to successfully answering the question posed in the Statement of Work.

To achieve these objectives, a subjective vehicle substitution algorithm was developed which required the identification of the mission load for each LMTV in an organization, the identification of a set or sets of alternative vehicles which could perform the load carrying mission, an identification of other operational requirements for the LMTV in question, and the selection of one or more sets of alternative vehicles based upon specified decision criteria. This algorithm is pictorially displayed in Figure B-II-4. The process by which this algorithm was applied is detailed in the paragraphs which follow.

Two ground rules and one assumption were adhered to throughout the analysis of vehicle missions using this algorithm. The ground rules were:

- o No substitution was to be made which would cause the unit to be incapable of performing its mission.
- o Vehicles were to be utilized only within their respective design specifications or known limitations.

The assumption was:

- o Requirements for trailer mounted systems such as water trailers, kitchen trailers, etc., were valid and would not be changed.

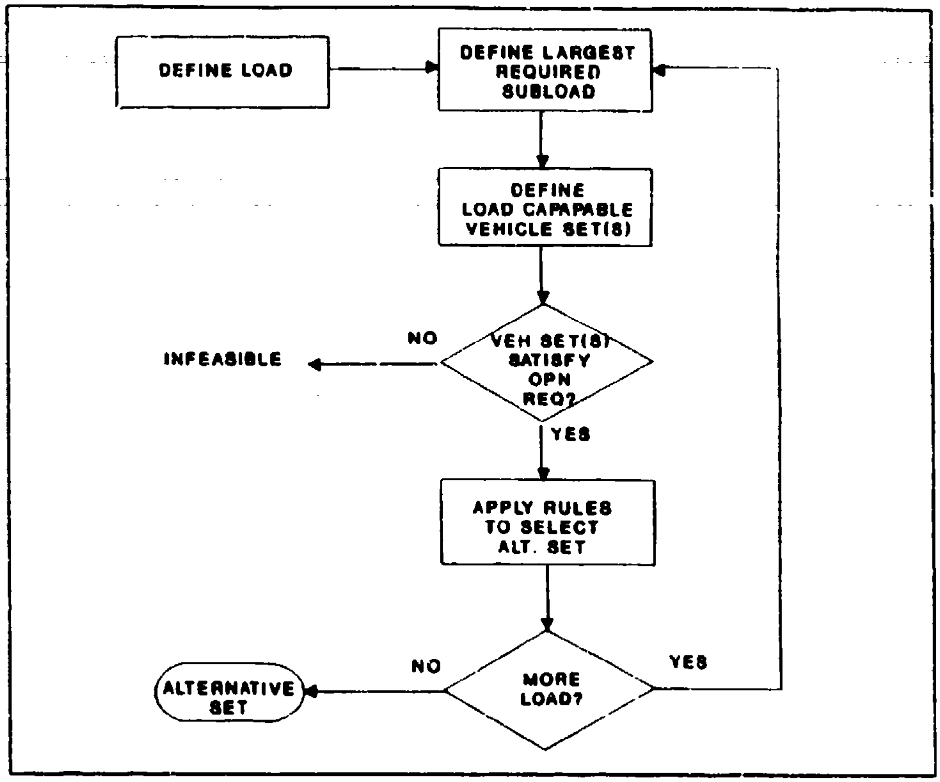


FIGURE B-II-4. SUBSTITUTION ALGORITHM

2.3.1 Define the Load. The first step in applying the algorithm is the definition of the load to be considered. Initially, the load of each LMTV, or LMTV with its associated trailer, in each TOE section in an organization was considered individually. Sequential passes through the algorithm thus resulted in the identification of an alternative set or sets of vehicles for each of the LMTVs in the organization. This process of looking at each load individually did not however consider the potential savings resulting from the reduction of vehicles through the consolidation of vehicle loads on a single larger vehicle. By simply defining the load with which the analyst entered the algorithm as the consolidated load of two or more LMTVs, whether they be in the same TOE section or not, this potential was evaluated using this same algorithm.

Having defined a specific load, the next step was to identify the loads characteristics; its weight and cube and whether or not it could be configured in such a manner as to permit the use of 5/4-ton trucks and/or trailers to transport it. In the algorithm, this step is described as "Define the Largest Required Subload". Since not only the truck but also its associated trailer was considered in defining the load, non-cargo trailers such as water and kitchen trailers were often identified as the largest subload. The results of this step permit the analyst to move on to the next major subtask.

2.3.2 Define Load Capable Vehicle Set(s). Based upon the characteristics of the load, one or more sets of vehicles, both trucks and trailers, were identified which were capable of transporting the required load. These alternative sets were selected using the vehicle payload capacities presented in Table B-II-1. If the feasible set of vehicles included 5/4-ton class vehicles, both the HMMWV and the CUCV were considered at this point. For LMTVs which were the prime mover for non-cargo trailers which could not be towed by smaller trucks, the only feasible substitute vehicle was the MTV.

2.3.3 Identify Other Operational Requirements. The next step in the process of applying the algorithm was to answer the questions, "What other operational requirements are there for the LMTV being considered for replacement?" and "Which of the alternative sets of vehicles identified in the previous step are capable of satisfying these requirements?" Other operational requirements included such things as providing recovery capability for other vehicles and equipment in the section, providing a backup capability under circumstances where other trucks in the organization might be not available some reason, and, based upon the unit's secondary mission, providing transportation capability for personnel or POWs.

If none of the alternative sets being considered at this point could perform these other operational requirements, then no feasible set of vehicles which could be substituted for the LMTV would have existed and the process would have been completed. This situation, however, was never encountered because the MTV, in terms of payload capability and operational requirements considered in the substitution analysis, was always a feasible substitute. Operational requirements did often preclude the substitution of 5/4-ton class trucks, as would have been the case in each of the examples given above. Having thus perhaps eliminated some of those alternative sets of vehicles and ensured that those sets still being considered could perform all of the functions of the vehicle being replaced, the analyst was prepared to select an alternative set.

2.3.4 Select Alternative Vehicle Set(s). Several decision rules could be considered at this point in the process. If the objective was to minimize the number of vehicles, and hence most likely also minimize the number of drivers and maintenance men required to support the truck fleet, then that set with the fewest vehicles might be selected. If, on the other hand, the objective was to minimize the cost of the alternative fleet, then, based upon the fact that the smaller 5/4-ton class of vehicles was less expensive in terms of dollars to procure and sustain, that set with the smaller vehicles might be selected.

As will be discussed later in this appendix, the TWVRMO employed the former of these decision rules in the development of Alternative 1, thus creating an all MTV replacement fleet. The SAIC study team, however, applied the later in accordance with SAG guidance to attempt to minimize the cost of alternative fleets.

With the selection of a vehicle or set of vehicles to handle the specific subload being considered, the process was completed. However, as indicated in Figure B-II-4, if this subload, or those considered previously, did not account for the entire load defined in the first step of the algorithm, then the analyst would return to consider the remaining portion of the load. Once the entire load had been processed in this manner, the complete alternative vehicle set would have been developed for this load.

2.3.5 Summary. In concluding this discussion of the substitution algorithm, it should be obvious why it was called a subjective algorithm earlier in this section and in Section 2 of this report. Because of the diverse nature of the many vehicle loads which the LMTV is required to transport and because of the unique operational environment in which military units and equipment must function, it was neither reasonably possible nor desirable to develop a more objective, perhaps even programmable, algorithm which could have been applied to a data base of vehicles and loads without further involvement of an analyst. Instead, this algorithm provided a framework in which the two analysts who conducted this portion of the analysis, each with over twenty years of active duty Army service, could identify alternative vehicle sets while ensuring that both the diverse loads and unique environment would be considered at all times.

3 SUBSTITUTION METHODOLOGY APPLICATION

Figure B-II-5 shows the steps which were executed in the process of applying the substitution methodology of paragraph 2 to the SRC subset of paragraph 1, which is shown in the top left corner of the figure.

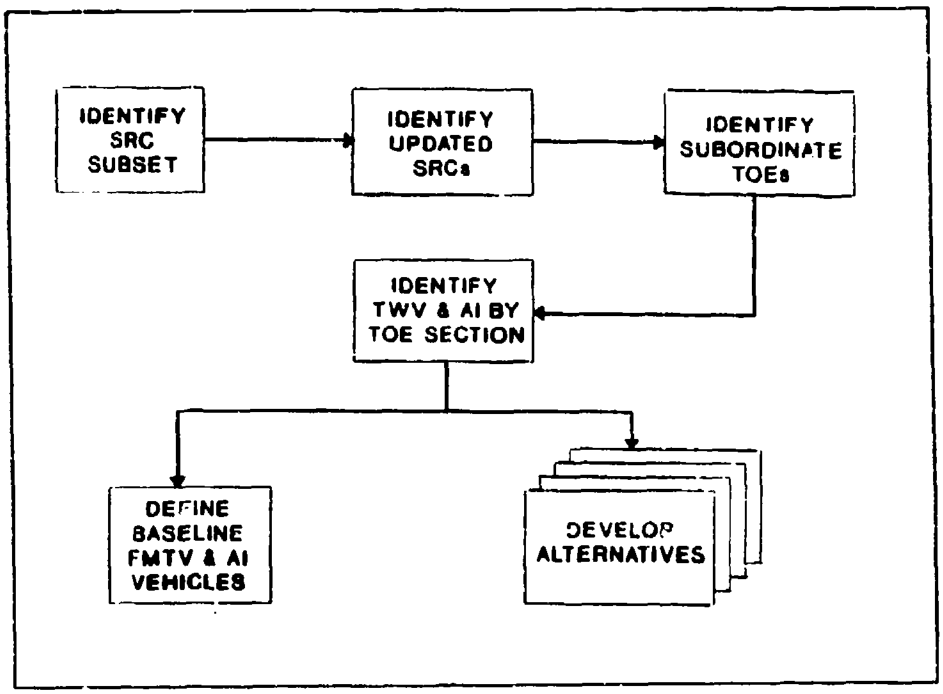


FIGURE B-II-5. SUBSTITUTION METHODOLOGY APPLICATION

The individual steps in this process are described in the subparagraphs which follow.

3.1 Identify Current SRCs and Subordinate TOEs.

The August 1988 LOGSACS data base includes both J-Series and L-Series SRCs. Thus the subset of 134 SRCs identified for detailed analysis also contained SRCs form both series. Since all SRCs have now been updated to L-Series SRCs, it was determined that only the L-Series documents should be used because they were more readily available and more current. TWVRMO provided the updated SRC listing and at the same time identified each of the subordinate TOEs from the TRADOC TOE Data Base which is resident on a computer at Fort Leavenworth. Like the LOGSACS data base, TRADOCs TOE Data Base is updated twice each year, with the updated data provided by TWVRMO being current as of October 1988. Figure B-II-6 displays an example of this process.

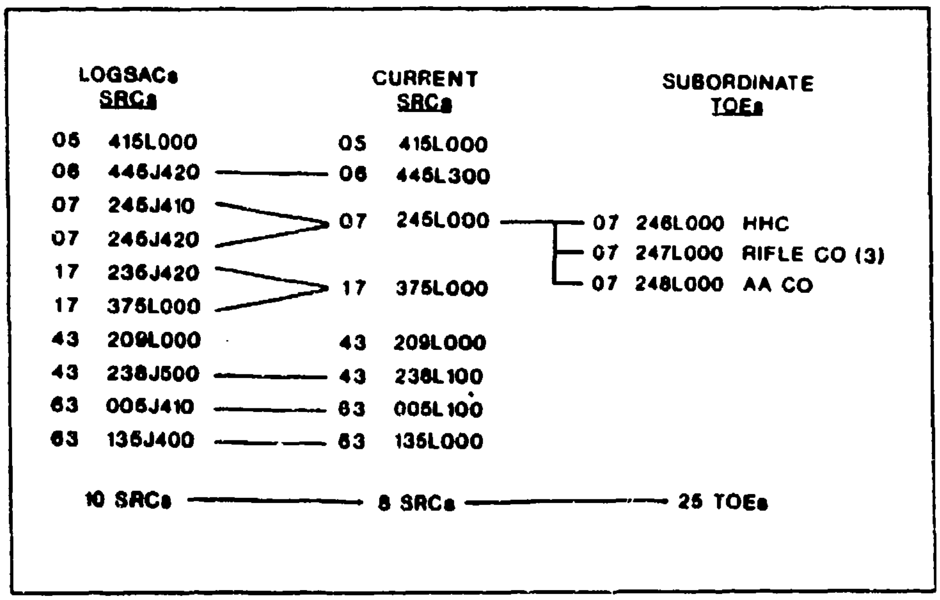


FIGURE B-II-6. IDENTIFYING SUBORDINATE TOES

As can be seen from the figure, some J-Series SRCs were combined during the process of converting to the L-Series. This had no impact upon the study except to slightly reduce the total number of SRCs for which subordinate TOEs had to be identified. Figure B-II-6 also makes the point that the number of TOEs exceeds the number of SRCs because there are generally several TOEs subordinate to each SRC. A total of 260 TOEs were identified by TWVRMO as subordinate to the original 134 SRCs or their replacements. It was on these TOEs that the detailed analysis of vehicle missions was accomplished.

3.2 Identify Vehicles by TOE Section.

Once the complete set of TOEs had been identified it was necessary to identify each 2 1/2-ton truck in each section of the TOEs. This also was accomplished by TWVRMO by extracting data from the Fort Leavenworth computer. However, the extracted data, a sample of which is shown in Figure B-II-7, did not reflect the FMTV requirements but instead contained only the set of current series 2 1/2 and 5-ton trucks. This was not unexpected, as the FMTV BOIP had not yet been officially approved and had therefore not yet been applied to the data base. Because of this situation an additional task had to be accomplished before the development of alternative fleets could begin, mainly the description of the Baseline FMTV vehicle sets for each of the 260 TOEs.

Even before this could be accomplished, however, it was necessary to develop a methodology by which the substitution analysis could be recorded. Thus to facilitate the recording of decisions regarding which vehicles would be substituted for each LMTV in the 260 TOEs and to provide an audit trail for these decisions, each of the TOE extracts was entered in a separate SYMPHONY spreadsheet designed so that not only the Baseline FMTV vehicle set but also each of the alternative vehicle sets developed for that TOE could be recorded. These spreadsheets were used throughout the rest of the operational analysis.

```
    TOE: 07240L000  HHC INF BN (MECH)

          PARA: 01  COMMAND SECTION
TWV T61494 TRUCK UTILITY: CARGO/TROOP CARRIER 1-1/4 TON 4X4 W/E (HMMWV)      2
          PARA: 02  S-1 SECTION
TWV W95811 TRAILER CARGO: 1-1/2 TON 2 WHEEL W/E                              1
*** X40009 TRUCK CARGO: 2-1/2 TON 6X6 W/E                                    1
          PARA: 03  S-2 SECTION
          PARA: 04  S-3 SECTION
TWV T61494 TRUCK UTILITY: CARGO/TROOP CARRIER 1-1/4 TON 4X4 W/E (HMMWV)      2
TWV W95811 TRAILER CARGO: 1-1/2 TON 2 WHEEL W/E                              1
*** X40009 TRUCK CARGO: 2-1/2 TON 6X6 W/E                                    1
          PARA: 05  S-4 SECTION
TWV T61494 TRUCK UTILITY: CARGO/TROOP CARRIER 1-1/4 TON 4X4 W/E (HMMWV)      1
          PARA: 06  COMPANY HEADQUARTERS
TWV T61494 TRUCK UTILITY: CARGO/TROOP CARRIER 1-1/4 TON 4X4 W/E (HMMWV)      2
TWV W95811 TRAILER CARGO: 1-1/2 TON 2 WHEEL W/E                              1
TWV W98825 TRAILER TANK: WATER 400 GALLON 1-1/2 TON 2 WHEEL W/E              1
*** X40009 TRUCK CARGO: 2-1/2 TON 6X6 W/E                                    2
          PARA: 07  BN COMM SEC
```

FIGURE B-II-7. IDENTIFYING VEHICLES BY TOE SECTIONS

3.3 Define Baseline Vehicle Sets for Each TOE.

The LMTV baseline vehicle set for each TOE was documented by TWVRMO on the TOE extract spreadsheet for each TOE by the manual application of the FMTV BOIP. During this process all LMTVs, both cargo and vans, in the 260 TOEs were identified by TOE section and all 2 1/2-ton trucks which were not either cargo trucks or vans were converted, in accordance with the BOIP, to the appropriate MTV variant. All trailer requirements within the TOEs were also updated to reflect FMTV BOIP requirements.

3.4 Develop Alternative 1 for Each TOE.

The first alternative set of vehicles for each TOE was developed by TWVRMO. This vehicle set, in addition to being called Alternative 1, is also referred to as the TWVRMO - HEAVY alternative because each of the LMTV cargo trucks in the Baseline vehicle set was converted to an MTV cargo truck in this alternative.[2] This vehicle set was created using the same guidelines and philosophy which TWVRMO uses to conduct its daily function of reviewing and validating tactical wheeled vehicle authorizations in the TOE development process.

Army Regulation 71-13 states that, "Vehicles will be included in TOEs, MTOEs, TDAs, and JTAs in the minimum justified and approved quantities required to provide essential mobility to maintain the mission capabilities of units and activities." This concept of minimum essential equipment is believed, because it results in the fewest pieces of equipment to accomplish the mission, to be the most advantageous to the Army in terms of minimizing the number of drivers and maintenance personnel required to operate and maintain the vehicle fleet. Since its establishment in 1980 the TWVRMO has standardized the process of reviewing and validating tactical wheeled vehicle requirements at the TOE level and has operated continuously with the objective of providing sufficient assets required to accomplish the mission while minimizing the number of people required. Since this philosophy was applied in the development of the FMTV BOIP, it is not surprising that the TWVRMO vehicle set has exactly the same number of vehicles as the Baseline vehicle set.

3.5 Develop Alternatives 2 - 4 for Each TOE.

Three additional primary alternative vehicle sets were created by SAIC for each of the TOEs using the substitution algorithm discussed in paragraph 2.3 of this appendix. These alternatives were:

- o Alternative 2 - LIGHT
- o Alternative 3 - HEAVY-CONSOLIDATED
- o Alternative 4 - LIGHT-CONSOLIDATED

Figure B-II-8 graphically displays the relationships of all four alternatives.

[2] For this and all other alternatives, the LMTV Van was converted in every instance to an MTV Van. Thus all further discussion of LMTVs in the development of alternative fleets will be in reference to the LMTV Cargo variant only.

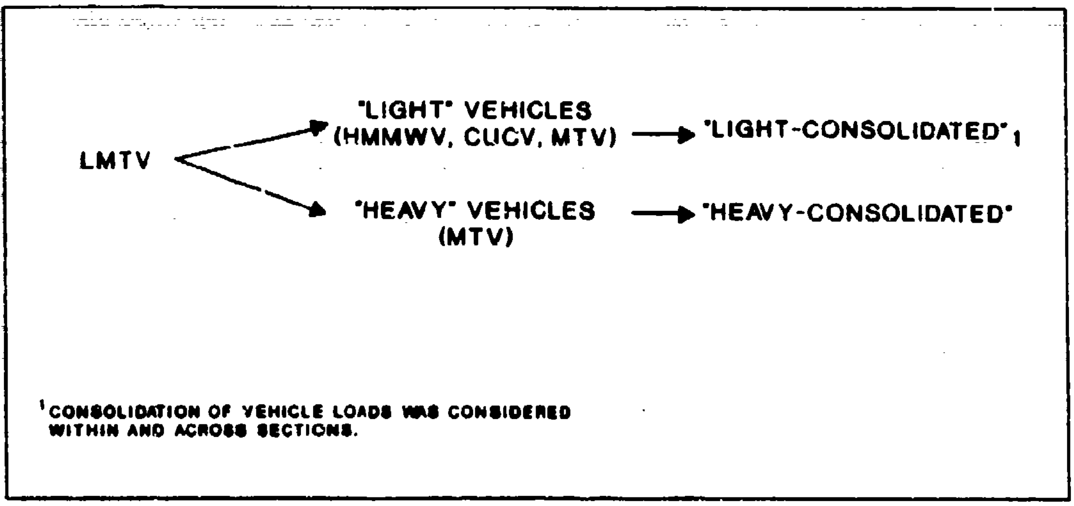


FIGURE B-II-8. PRIMARY ALTERNATIVES

While the HEAVY alternative, created by the TWVRMO and already discussed, minimizes the number of vehicles and people, the LIGHT alternative represents the study teams attempt to reduce fleet costs by maximizing the number of LMTV missions transferred to the less expensive 5/4-ton class of truck. This alternative was created by applying the least cost decision rule in the substitution algorithm discussed in paragraph 2.3.4 above. Where the downsizing of vehicles was possible, the choice between HMMWVs and CUCVs was made based upon an assumption that the CUCV provided adequate mobility as a replacement for the LMTV in those units which operated primarily behind the brigade rear boundary and which already had CUCVs in the unit. This alternative obviously also includes MTVs since all LMTV payloads cannot be configured to the 5/4-ton trucks.

The HEAVY-CONSOLIDATED and LIGHT-CONSOLIDATED alternatives were created by taking advantage of the increases in payload weight and cube capacity realized each time an MTV is substituted for an LMTV. By defining the load in the substitution algorithm to be the combined loads of two or more LMTVs in a TOE section or sections, the increased payload capacity of the MTV was used to advantage in reducing the total number of vehicles required within the section or sections.

The development of the Baseline and Alternative vehicle sets for each of the 260 TOEs completed this portion of the operational analysis. In Appendix III the results of the TOE level analysis are aggregated to the 134 SRC subset level and then projected to the fleet level.

APPENDIX III

to

ANNEX B

BASELINE AND ALTERNATIVE FLEETS

The purpose of this Appendix is to explain how the Baseline and Alternative Fleets shown in Table 3-1 of Section 3 were developed from the results of the substitution analysis explained in Appendix II, to discuss the reasons why the differences between the alternative fleets are so small, and to explain how the Special Interest Alternatives shown in Table 3-4 and the Requirements Based Alternatives shown in Table 3-7 were developed.

1 BASELINE FLEET

The Baseline Fleet includes 30,467 LMTVs and 67,413 MTVs based upon the Tactical Wheeled Vehicle Modernization Plan Procurement Strategy. The distribution of these vehicles by variant was based upon the distribution of LMTV and MTV variants in the FMTV BOIP and the 43,255 trailers in the fleet were based upon the trailer requirements defined in the Modernization Plan itself. The development of this fleet is discussed in detail in paragraph 2, Vehicle Requirements, of Appendix I of this Annex. Since this fleet was not based upon the SRC subset sample upon which all alternative fleets were based, its development need not be discussed again in this section.

The Baseline Fleet represents the projected Army inventory of FMTV vehicles in the year 2020 if the TWV Modernization Plan Procurement Strategy is executed as now planned. As such, it is the fleet against which all alternative fleets were compared both in costs and operational characteristics.

2 ALTERNATIVE FLEETS

This paragraph explains how the separate alternative vehicle sets for each of the 260 TOEs were consolidated into vehicle sets for each alternative over the entire subset sample. These sets for each of the alternatives were then used to determine conversion factors which described the ratios of LMTVs and trailers in the baseline vehicle set to MTVs, HMMWVs, CUCVs, and trailers in each of the alternative vehicle sets over the entire 134 SRC subset. These conversion factors for each alternative were then applied to the baseline fleet LMTVs and trailers to determine the number of vehicles in each of the alternative fleets.

2.1 Subset Vehicle Fleets.

The Baseline and Alternative vehicle sets which were developed during the substitution analysis described in Appendix II for each of 260 TOEs were aggregated to determine the baseline and alternative vehicle sets which were representative of that slice of the Army, including the National Guard, Army Reserve, and POMCUS, which was described in the entire 134 SRC subset.

The vehicle sets for each TOE were weighted by the number of units in the FY97 Objective Force organized under that TOE and then summed. The SRC subset vehicle sets compiled in this way are shown for cargo trucks in Table B-III-1. Similar mappings of trailers were compiled but are not presented.

TABLE B-III-1. CARGO VEHICLE MAPPING FUNCTION

TYPE	BASE	ALT 1	ALT 2	ALT 3	ALT 4
LMTV	35049	0	0	0	0
MTV	0	35049	33348	34986	33285
HMMWV	0	0	1902	0	1902
CUCV	0	0	1106	0	1106
TOTAL TRUCKS	35049	35049	36356	34986	36293
% CHANGE	N/A	0.0	+3.7	-0.2	+3.5

It should be noted that the 35,049 LMTVs in Table B-III-1 do not match the number of LMTVs identified as being included in the SRC subset in Appendix II. This is because the LMTVs in Table B-III-1 are only cargo trucks and the 35,995 LMTVs in the SRC subset also included LMTV vans. Actually, however, there were a total of 2180 vans in the SRC subset for a total of 38,175 LMTVs for which detailed mission analysis was conducted. This number differs from the original SRC subset number because of the slight differences between L-Series TOEs and J-Series TOEs.

2.2 Conversion Factors.

From the data in Table B-III-1, conversion factors were calculated for each of the alternative vehicle sets. These factors describe the number of each type substitute vehicle which resulted from the elimination of the LMTVs from the baseline vehicle set. Figure B-III-1 demonstrates these conversion factors for the cargo trucks of Alternative 2, the LIGHT alternative.

BASELINE	ALTERNATIVE 2	FACTOR
	33348 MTVs	.951
35049 LMTVs	1902 HMMWVs	.054
	1106 CUCVs	.032
35049 LMTVs ⟶	36356 TRUCKS	1.037

FIGURE B-III-1. ALTERNATIVE 2 CARGO TRUCK CONVERSION FACTORS

As can be seen from the figure, as a result of the substitution analysis, 95.1% of the LMTV cargo trucks in the baseline vehicle set were converted to MTV cargo trucks while 4.9% of the LMTVs were converted to 5/4-ton trucks. Because most of the LMTVs replaced by smaller vehicles were replaced on a 2-for-1 basis, the total number of trucks in the Alternative 2 vehicle set was 3.7% greater than that in the Baseline vehicle set.

2.3 Alternative Fleets.

The final step in developing the Alternative Fleets was to apply the conversion factors resulting from the substitution analysis to the Baseline Fleet discussed in paragraph 1 above. Figure B-III-2 demonstrates this process for the LMTV cargo trucks of Alternative 2.

BASELINE	FACTOR		ALTERNATIVE 2
	.951	=	26727 MTVs
28090 LMTVs	.054	=	1524 HMMWVs
	.032	=	886 CUCVs
28090 LMTVs ⟹	1.037	=	29137 TRUCKS

FIGURE B-III-2. ALTERNATIVE 2 CARGO TRUCK CALCULATIONS

When this process was completed for each alternative, the number of cargo trucks in each alternative resulting from the elimination of the LMTVs was as shown in Table B-III-2. These numbers differ from the MTV cargo truck numbers shown in Table 3-1 of Section 3 of this report because these numbers do not include the 21303 MTVs which were in the Baseline Fleet originally. Also, the percent change in the number of vehicles differs between Table B-III-2 and Table 3-2 because the former considers only the cargo trucks while the later includes all variants of both the LMTV and the MTV.

TABLE B-III-2. LMTV REPLACEMENT VEHICLES

TYPE	BASE	ALT 1	ALT 2	ALT 3	ALT 4
LMTV MTV HMMWV CUCV	28090 0 0 0	0 28090 0 0	0 26727 1524 886	0 28040 0 0	0 26677 1524 886
TOTAL TRUCKS	28090	28090	29137	28040	29087
% CHANGE	N/A	0.0	+3.7	-0.2	+3.5

The fact that the differences between Alternative Fleets are small is discussed in the next paragraph.

3 DISCUSSION OF BASELINE AND ALTERNATIVE FLEETS

3.1 Fleet Similarities.

Table B-III-2 indicates that there is little difference between the alternative fleets in terms of the number and types of vehicles. This similarity is reflected in the results of both the cost analysis and the evaluation of fleet characteristics.

In the process of identifying alternative vehicle sets to accomplish the missions of the LMTVs and to reduce the overall costs of the FMTV vehicle fleet, emphasis was placed on maximizing the number of 5/4-ton vehicles utilized and maximizing the consolidation of LMTV missions in a reduced number of MTVs. Since, however, few instances were identified in which the downsizing of vehicles or the consolidation of missions could be achieved, the resulting fleets had few differences. The reasons why these efforts met with only limited success are linked to the concept of "mi ' ıum essential equipment" under which TOE vehicle authorizations are reviewed ınd validated by the TWVRMO.

Under the concept of minimun essential equipment, only sufficient payload capacity required to accomplish the mission is provided and the number of vehicles is minimized. Minimizing the number of vehicles reduces costs in terms of both people and dollars. Thus when given the alternative of two or more smaller vehicles or a single larger vehicle to support a particular mission requirement, the Army, in its TOE review and validation process, opts for the single vehicle.

Through the emphasis placed on providing <u>only</u> the required payload capability to accomplish the mission, the Army has very closely matched the payload capabilities of its fleet, down to the individual vehicle level, with the requirements which that fleet must satisfy . Thus few opportunities to downsize the vehicles in TOE organizations were found by the study team.

Similarly, the concept of minimun essential equipment, and particularly the care with which the concept is applied, is responsible for why fewer consolidation opportunities were identified than expected. Most of the potential consolidation opportunities identified by the study team had already been considered and been rejected by the Army for one or more of the following reasons: the cube requirements of potential consolidated loads exceeded the MTV capacity; the number of prime movers required within a section/organization would not permit elimination of trucks; many trucks were assigned special function missions in support of a specific organization/subordinate unit and could not be eliminated; and, the requirement to asssure the timely availability of sufficient vehicles to accomplish all unit missions often prevented elimination of trucks.

The bottom line on why there is great similarity between the alternative fleets is that the Baseline Fleet matches the Army's requirements so closely that few opportunities to either downsize the fleet or to consolidate missions can be identified.

3.2 The 5/4-ton Trailer.

There were no 5/4-ton trailers in any of the primary alternatives because, at the time of the substitution analysis, the notional 5/4-ton trailer was, according to TACOM, only a 1-ton trailer. The reason why a 1-ton trailer had no utility in the substitution analysis is discussed in this paragraph.

Cargo vehicles, and vehicle sets, considered for elimination during the substitution analysis included the LMTV, the LMTV with 1 1/2-ton trailer, and the LMTV with 2 1/2-ton trailer. These vehicle sets had total payload capacities of 2.5, 4, and 5 tons respectively. Potential 5/4-ton substitute vehicles could be combined with either the existing 3/4-ton trailer or the 1-ton trailer.

When replacing an LMTV without a trailer, two 5/4-ton trucks were required as neither the 3/4-ton trailer nor the 1-ton trailer when combined with a single 5/4-ton truck could provide sufficient payload capability.

When replacing an LMTV with 1 1/2-ton trailer, two 5/4-ton trucks each with a 3/4-ton trailer provided the required 4 ton payload capacity. In this case the additional capacity provided by the use of the 1-ton trailer was in excess of that required and thus this option was not selected.

When replacing an LMTV with 2 1/2-ton trailer, even the use of the 1-ton trailer with two 5/4-ton trucks was insufficient to provide the required payload capacity unless three trucks were utilized. This option was not selected since the use of three trucks would have been more expensive than to utilize a single MTV.

While in none of these cases would a 1-ton trailer have had any utility, in two of the cases, mainly when replacing an LMTV without a trailer or an LMTV with a 2 1/2-ton trailer, a 5/4-ton trailer would have been useful. Because of this situation, a special interest alternative (Alternative 5) was developed to evaluate the impact of the availability of a 5/4-ton trailer if one really existed. The development of this alternative is discussed in the next paragraph.

4 SENSITIVITY FLEETS

In addition to the Baseline and four Alternative Fleets already discussed, two special interest fleets were investigated at the request of the SAG and the Baseline and Alternative 4 Fleets were projected to the Modernization Plan requirements for 129,918 LMTVs and MTVs for cost comparision purposes. These fleets are discussed briefly in this paragraph.

4.1 Alternative 5 - LIGHT CONSOLIDATED with 5/4-ton Trailer.

This alternative was created and measured against the LIGHT - CONSOLIDATED Fleet in Section 3 of the report so that the impact of a 5/4-ton trailer, should one exist, on the fleet mix and cost could be estimated.

This alternative vehicle mix was created by identifying in the LIGHT - CONSOLIDATED Fleet each instance where either an LMTV without trailer or an LMTV with 2 1/2-ton trailer was considered for eliminated in favor of smaller 5/4-ton vehicles. In the case of an LMTV without trailer, this alternative substituted one 5/4-ton truck with a 5/4-ton trailer in lieu of the two 5/4-ton trucks substituted in Alternative 4. Similarly, two 5/4-ton trucks with two 5/4-ton trailers were substituted for each LMTV and 2 1/2-ton trailer combination in Alternative 4.

These substitution changes resulted in a net increase of 312 trailers and a decrease of 312 5/4-ton trucks from Alternative 4. The reduced number of 5/4-ton trucks, although smaller than perhaps anticipated because of the low number of HMMWV/CUCV substitutions in Alternative 4, represents a potential for the conversion of 13% of all 5/4-ton trucks in this fleet to trailer. The cost savings from this alternative, both in terms of dollars and manpower, are discussed in Sections 3 and 4 of the report.

4.2 Alternative 6 - LIGHT CONSOLIDATED without the CUCV.

The TWV Modernization Plan Procurement Strategy does not include provisions for the procurement of any new CUCVs during the 1991 to 2020 timeframe. Consequently, this alternative assumes that no new CUCVs will be procured and replaces each CUCV in Alternative 4 with a HMMWV cargo vehicle. This alternative is therefore identical to Alternative 4 except for the number of HMMWVs and CUCVs in the fleet. The numbers of vehicles in this fleet as well as the cost impact are presented in Section 3 of this report.

4.3 Requirements Based (130K) Alternatives.

Because the Baseline mix of LMTV and MTV vehicles changes from 44.8% LMTV in the TWV Modernization Plan to only 31.1% LMTV in the Modernization Plan's Procurement Strategy, it was believed that the cost differential between the Baseline Fleet and the Alternatives would also vary depending upon which total baseline fleet is used. For comparison purposes the Baseline Fleet of 97,880 LMTV and MTV vehicles and the Alternative 4 Fleet presented in Tables 3-1 through 3-3 are presented in terms of the Modernization Plan total requirement of 129,918 LMTV and MTV vehicles in Tables 3-7 through 3-9. These requirements based fleets were developed in the same manner and using the same assumptions as the Baseline Fleet of 97,880 vehicles.

Because of the different ratio of LMTV to MTV vehicles in the Baseline Fleet in Table 3-7 from that in Table 3-1, the percent change in the total number of trucks in Table 3-8 is 1.5% compared to 1.0% in Table 3-2 and the percent change in the total number of trailers in Table 3-9 is 3.0% compared to 2.1% in Table 3-3. These differences are also reflected in the fleet costs discussed in Section 3 of the report.

APPENDIX IV

to

ANNEX B

FLEET CHARACTERISTICS - DEPLOYABILITY

1 GENERAL

Five of the six fleet characteristics evaluated in this study were discussed in their entirety in Section 4 of this report. These five characteristics were: Payload capacities, Mobility, Transportability, Manpower requirements, and Operational impact. The sixth fleet characteristic, Strategic Deployability, is discussed in greater depth in this Appendix.

2 STRATEGIC DEPLOYABILITY

Simulated air deployment of divisional Baseline and Alternative Fleets were conducted to determine the impact of alternative fleets upon strategic transport requirements. The air deployments were conducted using the Automated Aircraft Load Planning System (AALPS). The AALPS facility at the US Army Logistics Center, Fort Lee, Virginia, graciously provided the support to conduct the data input, computer processing, and output printing for the large number of computer runs that were necessary for the analysis.

2.1 AALPS.

AALPS is still classified as prototype software but is used as an operational system by the CINCs, a number of TRADOC schools, CAC, the 18th Airborne Corps, and by the Army Staff. The system is maintained and improved by International Business Systems (IBS), which provided the AALPS operator for the runs conducted at Log Center. AALPS may be operated in a strategic or tactical deployment mode, and will optimize equipment loads where feasible. There are two key differences between strategic and tactical deployments in the normal use of AALPS. First, strategic deployments are normally made by major units, and equipment is loaded in the most efficient manner without regard to subunit integrity. Tactical deployments will normally move company or battalion sized units as integral packages, and thus not optimize the use of aircraft capabilities. Second, strategic loads are moved long distances so that Aircraft Loads (ACLs) are reduced below the maximum capability of the aircraft. Tactical loads normally move shorter distances so that the ACL is higher. For the AALPS runs supporting this Truck Study, the involved vehicles were deployed strategically on C-141B aircraft using an ACL of 60,000 pounds. There is a great variation in ACLs depending upon the requirements of the planner. For example, CAC conducts strategic air deployments using an ACL of 75,000 pounds, while CINCPAC uses 45,000 pounds due to the long distances in that theater. The 60,000 pound ACL .s normally used at the Log Center for strategic deployments and, coincidently, is bracketed by the other two cited examples. The maximum ACL for the C-141B is 90,000 pounds.

2.2 Special Considerations using AALPS.

There were two situations in deploying the truck fleet where it was necessary to modify the input data. They were for axle loads and for the 5-ton vans, which had to be removed from the chassis before loading in the aircraft. The maximum axle load for the C-141B floor is 10,000 pounds. There were a few cases where the axle loads on the new family of vehicles exceeded 10,000 pounds. In these cases, the axle loads were made 10,000 pounds in recognition that the new vehicles have balloon tires with variable inflation pressures so that the loads would be spread over a much larger floor area compared to the high pressure tires on current vehicles. According to AALPS operators, this practice is acceptable to the Air Force as an interim measure until they produce a new standard based upon the new configurations.

The only vehicle configuration which exceeded the 105-inch height capability of the C-141B was the 5-ton van. The van body was removed from the truck chassis and made into an equivalent 3-pallet load. This represented the area covered by the van body, and carried the actual weight of the body. The 5-ton chassis was moved simply as a 5-ton chassis. The other vehicles which normally exceed the height capability of the C-141B ($2\frac{1}{2}$-ton van, $2\frac{1}{2}$- and 5-ton ambulances, and the 5-ton wrecker) are collapsible to less than 105 inches in height.

After the above-described adjustments were made, AALPS was given the vehicles of each division, and run. Division-sized units were not deployed for this truck study; rather, only the trucks involved in the study were transported. No additional adjustments were made. It is interesting to note that the greatest sensitivity between alternatives stems from the fact that three $2\frac{1}{2}$-ton trucks will fit on a C-141B while only two 5-ton trucks will fit. Tables B-IV-1 thru B-IV-3 present vehicle summaries by alternative for the Airborne, Heavy, and Air Assault Divisions respectively. Table B-IV-4 presents the results of the AALPS simulations in terms of the number of sorties required to move the equipment in Tables B-IV-1 thru B-IV-3.

Table B-IV-1. Vehicle Summary by Alternative - Airborne Division

TYPE	LIN	NOMENCLATURE	Base-line	Alt 1 Heavy	Alt 2 Light	Alt 3 Hvy Con	Alt 4 Lt Con
2½-Ton LMTV	Z40430	Cargo	444				
	Z94492	Van					
5-Ton MTV	Z40439	Cargo	100	544	480	527	464
	Z40337	Cargo, LWB	6	6	6	6	6
	Z93626	Cargo w/MHE					
	Z93558	Cargo, LWB w/MHE					
	Z94560	Van (Expndble)					
	Z93669	Dump					
	Z94433	Wrecker	16	16	16	16	16
	Z94047	POL (1,500 gal)	1	1	1	1	1
	Z85341	Tractor	34	34	34	34	34
	Z39788	Ambulance					
Cargo Trls	W95537	3/4-Ton			56		56
	W95811	1 1/2-Ton	78	78	71	78	71
	Z36068	2 1/2-Ton LMTV	96	96	76	96	76
	Z90712	5-Ton					
	-	1-Ton New-TACOM					
HMMWV	T61494	Cargo			110		110
	T61562	Cargo w/Winch					
CUCV	T59346	Cargo w/Commo					
	T59482	Cargo			18		18
	T05028	Utility					
		Total	775	775	868	758	852

Table B-IV-2. Vehicle Summary by Alternative - Heavy Division

TYPE	LIN	NOMENCLATURE	Base-line	Alt 1 Heavy	Alt 2 Light	Alt 3 Hvy Con	Alt 4 Lt Con
2½-Ton LMTV	Z40430	Cargo	712				
	Z94492	Van	27				
5-Ton MTV	Z40439	Cargo	236	948	916	946	914
	Z40337	Cargo, LWB					
	Z93626	Cargo w/MHE	4	4	4	4	4
	Z93558	Cargo, LWB w/MHE	3	3	3	3	3
	Z94560	Van (Expndble)	22	49	49	49	49
	Z93669	Dump	28	28	28	28	28
	Z94433	Wrecker	27	27	27	27	27
	Z94047	POL (1,500 gal)					
	Z85341	Tractor	153	153	153	153	153
	Z39788	Ambulance					
Cargo Trls	W95537	3/4-Ton			64		64
	W95811	1 1/2-Ton	344	344	312	344	312
	Z36068	2 1/2-Ton LMTV	228	228	228	228	228
	Z90712	5-Ton					
	-	1-Ton New-TACOM					
HMMWV	T61494	Cargo			56		56
	T61562	Cargo w/Winch					
CUCV	T59346	Cargo w/Commo					
	T59482	Cargo			15		15
	T05028	Utility					
		Total	1,784	1,784	1,855	1,782	1,853

Table B-IV-3. Vehicle Summary by Alternative - Air Assault Division

TYPE	LIN	NOMENCLATURE	Base-line	Alt 1 Heavy	Alt 2 Light	Alt 3 Hvy Con	Alt 4 Lt Con
2½-Ton	Z40430	Cargo	425				
LMTV	Z94492	Van	32				
5-Ton	Z40439	Cargo	181	606	581	602	577
MTV	Z40337	Cargo, LWB	72	72	72	72	72
	Z93626	Cargo w/MHE					
	Z93558	Cargo, LWB w/MHE					
	Z94560	Van (Expndble)	8	40	40	40	40
	Z93669	Dump					
	Z94433	Wrecker	23	23	23	23	23
	Z94047	POL (1,500 gal)					
	Z85341	Tractor	44	44	44	44	44
	Z39788	Ambulance					
Cargo	W95537	3/4-Ton			42		42
Trls	W95811	1 1/2-Ton	214	214	197	214	197
	Z36068	2 1/2-Ton LMTV	116	116	110	116	110
	Z90712	5-Ton					
	-	1-Ton New-TACOM					
HMMWV	T61494	Cargo			6		6
	T61562	Cargo w/Winch					
CUCV	T59346	Cargo w/Commo					
	T59482	Cargo			44		44
	T05028	Utility					
		Total	1,115	1,115	1,159	1,111	1,155

Table B-IV-4. C-141B Aircraft Sortie Requirements for Alternatives

		Airborne Division		
Alter-natives	Description	Pieces of Equip	Type Loads	Sorties
Baseline	FMTV	775	8	250
Alt 1	TWVRMO	775	10	316
Alt 1a*	5-Ton w/Full Load	775	9	316
Alt 2	SAIC Light	868	12	302
Alt 3	SAIC Heavy Consd	758	8	308
Alt 4	SAIC Light Consd	852	9	294

		Heavy Division			Air Assault Division		
Alter-natives	Description	Pieces of** Equip	Type Loads	Sorties	Pieces of** Equip	Type Loads	Sorties
Baseline	FMTV	1,806	13	555	1,123	13	365
Alt 1	TWVRMO	1,833	11	655	1,155	9	434
Alt 2	SAIC Lt	1,904	18	651	1,199	15	429
Alt 3	SAIC HCon	1,831	11	654	1,151	9	432
Alt 4	SAIC LCon	1,902	18	650	1,195	15	427

* - Alternative 1 places a 2½-ton load on all 5-ton vehicles which replaced 2½-ton vehicles. Alternative 1a places a 5-ton load on all 5-ton vehicles replacing 2½-ton vehicles to determine the sensitivity to the additional load. Since the load on the vehicles makes no difference in sorties, Alternative 1a is not run for the other divisions.

** - The pieces of equipment moved will not be the same as the total number of vehicles in the division because the 5-ton vans must be disassembled and moved as two pieces.

To make comparisons for the impact upon division deployments, the number of sorties required to move divisions (not heavy divisions) was obtained from the Combined Arms Center (CAC) at Fort Leavenworth and is reported subsequently in Table B-IV-5.

Table B-IV-5. Aircraft Sorties to Move Whole Divisions and Baseline Alternative Trucks (Strategic Deployment)

Division*	Number of C-141 Sorties	
	Whole	Trucks
Airborne	703	250
Heavy	N/A	555
Air Assault	1,154	365
Light Infantry	521	No 2½-tons

ANNEX C

COST ANALYSIS DETAILS

1.0 INTRODUCTION

This annex is intended to serve as an audit trail from the findings and conclusions presented in Section 3.2 to the raw data and modelling processes upon which they were derived. It provides a complete and detailed account of the structure and findings of the cost analysis.

The Truck Life Cycle Cost (LCC) model consists of two symphony based spreadsheets. They shall be referred to in this annex as the Truck LCC model (which estimates production and fielding costs) and the sustainment model (which estimates sustainmen costs). The flow of information between both models begins with the user selecting a vehicle fleet to estimate within the production model. The choices are limited to the baseline or one of the six alternative fleets. The Truck LCC model generates both the production and fielding cost estimates on an annual basis predicated upon an annual distribution of production quantities. The sustainment model imports the fielding quantity distribution from the Truck LCC model. These quantities are then used in conjunction with a distrubution of active, reserve and POMCUS vehicles, to calculate sustainment costs. The distribution scheme this analysis used was that all active vehicles were fielded first, followed by all reserve vehicles and POMCUS vehicles. Estimation of sustainment costs on a per truck basis is based upon the hypothesis that direct operating costs increase with vehicle age and annual miles driven. Together, these two models form the basis of the life cycle cost estimate for the chosen vehicle fleet.

All cost data resides in the Truck LCC model. The sustainment model is simply a framework to accept the selected vehicle fielding quantities and sustainment cost data from the Truck LCC model. All formulas for estimating sustainment costs by active, reserve and POMCUS are built into the sustainment model.

Variables that can be changed include vehicle life, number of assigned drivers, annual miles driven and vehicle quantities by fleet. An important set of fixed parameters are the LMTV and MTV annual production quantities from FY90 through FY2020. These quantities served as the basis for generating the annual spreads for the HMMWV and CUCV trucks and all trailers. They also are a direct input from the truck modernization plan. A flowchart is provided to supplement this overview discussion.

2.0 MODEL INPUTS

All cost data resides in the input section of the production model. The source of all cost and quantity data for this analysis was either TACOM or the truck modernization plan. The sustainment model shares the input values from the production model. These data are broken into the following general areas:

- o Unit Procurement Cost (UPC) and fielding costs.
- o Personnel cost factors, such as the number of assigned drivers and annual crew costs.
- o Sustainment cost factors such as fixed annual costs and variable costs.

2.1 UPC AND FIELDING COSTS

Production cost estimates are generated, for each vehicle, within the Truck LCC model using based upon a single weighted average UPC for each family of vehicles. The weighted average represents was calculated from the actual vehicle mix in each fleet. That is, one UPC represented all LMTV vehicles and one UPC represented all MTV vehicles in each fleet. The UPC for the HMMWV and CUCV represent the cargo variant for each and a single UPC was used for each trailer. The decision to use a weighted average UPC was based upon several factors. First, there are several variants within both the LMTV and MTV weight classes, each with its own unique UPC. Second, this study compares a baseline fleet with both LMTV and MTV vehicles and trailers to six alternative fleets with

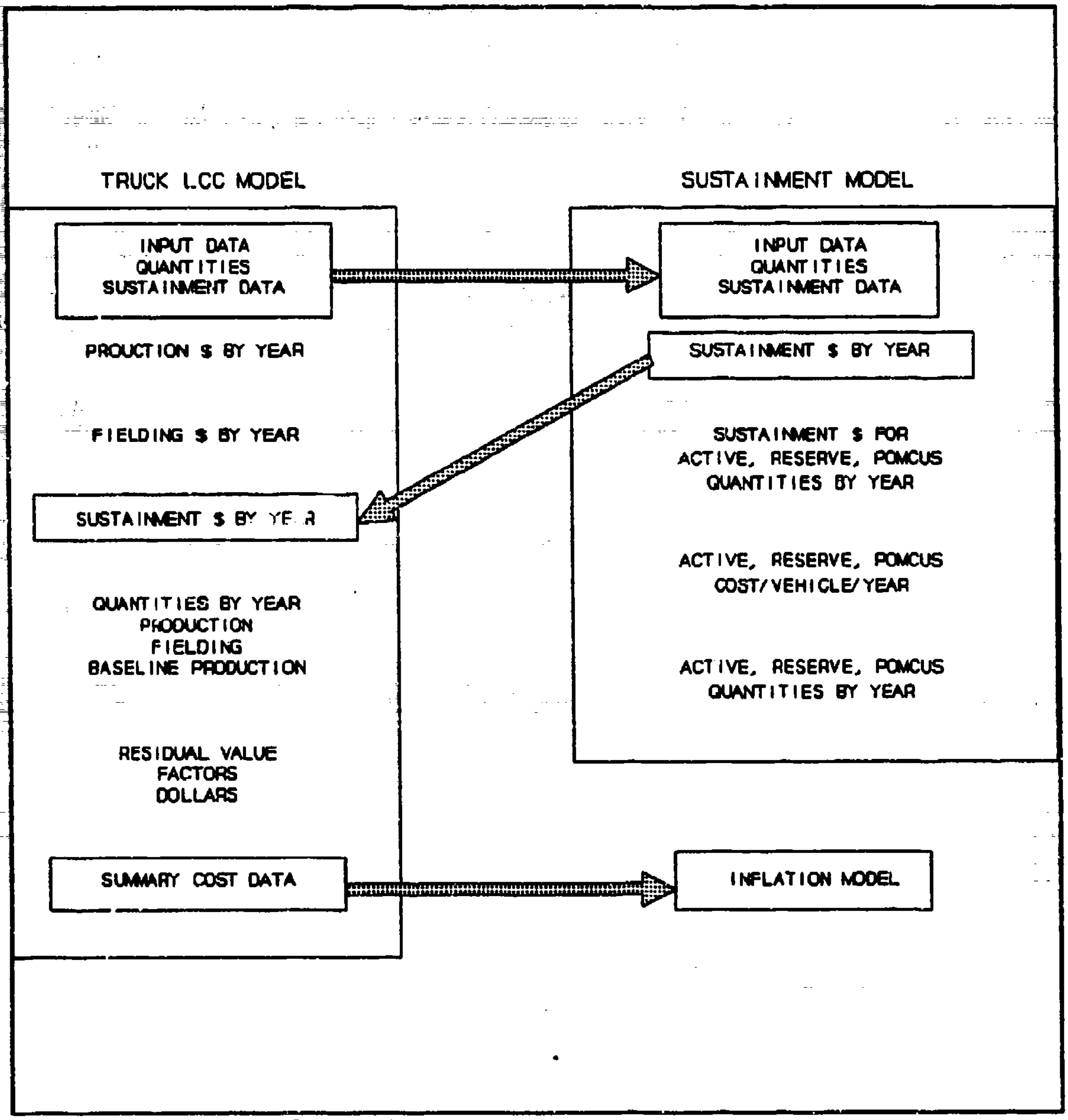


FIGURE C-1. MODEL FLOWCHART

much larger quantities of MTV trucks and no LMTV trucks. It is this disparity in the quantity of MTV trucks across fleets which strongly favors the use of a weighted average UPC. The UPC's used by the model to estimate all production costs are presented in Table C-1.

TABLE C-1. UNIT PROCUREMENT COSTS

	BASE	ALT 1	ALT 2	ALT 3	ALT 4	ALT 5	ALT 6	130,000 SENSITIVITY BASE	ALT4
WEIGHTED LMTV UPC	61.35							61.35	
WEIGHTED MTV UPC	86.33	83.70	83.70	83.70	83.70	83.70	83.70	86.33	82.59

The source data used to develop the weighted UPC's is presented in Table C-2. It was determined that this source UPC data did not include resources for applicable truck kits such as Bow and Tarp, winches, etc. and Federal Excise Tax (FET). Table C-3 provides the results of calculations for FET and kit costs as they apply to individual trucks. These costs are added to the source data in order to develop the total dollars and the calculated weighted UPC's inclusive of kit and FET. Table C-4 presents the weighted average UPC's.

In Table C-4, the MTV UPC used by each of the alternative fleets was 83.70. This value differs from that used by the baseline fleet due to the relative weighting of the quantities between the baseline and each alternative fleet. The base line fleet was composed of 67,413 MTV trucks. However, each alternative fleet had 67,413 MTV trucks, as well as approximately 30,000 additional MTV trucks acting as replacements for the 30,467 LMTV trucks. As Table C-4 illustrates, the MTV weighted average UPC across all the alternative fleets varied slightly. Consequently, in order to ease model computation and complexity, a single average UPC for the MTV was developed and used for the MTV and MTV (LMTV) trucks in Alternatives 1-6.

This study also conducted a sensitivity consisting of a total procurement quantity of 130,000. Tables C-5 and C-6 provide the quantities and weighted UPC's for this sensitivity analysis.

Table C-2. UNADJUSTED UPC COST AND QUANTITY DATA

FY90C$ UPC INPUTS W/O KIT OR FET	QUANTITIES	BASE	ALT 1	ALT 2	ALT 3	ALT 4	ALT 5	ALT 6
58.0	LMTV CARGO	28,090	0	0	0	0	0	0
84.0	LMTV VAN	2,377	0	0	0	0	0	0
	SUMMATION	30,467	0	0	0	0	0	0
204.0	AMBULANCE	23	23	23	23	23	23	23
68.0	CARGO	21,303	49,393	48,030	49,343	47,980	7,980	47,980
71.0	CARGO LWB	2,225	2,225	2,225	2,225	2,225	2,225	2,225
92.0	CARGO W/MHE	5,595	5,595	5,595	5,595	5,595	5,595	5,595
94.0	CARGO LWB W/MHE	270	270	270	270	270	270	270
125.0	VAN	2,292	4,669	4,669	4,669	4,669	4,669	4,669
74.0	DUMP	8,022	8,022	8,022	8,022	8,022	8,022	8,022
169.0	WRECKER	5,056	5,056	5,056	5,056	5,056	5,056	5,056
98.0	POL	674	674	674	674	674	674	674
68.0	TRACTOR	21,953	21,953	21,953	21,953	21,953	21,953	21,953
	SUMMATION	67,413	97,880	96,517	97,830	96,467	96,467	96,467

TABLE C-3. KIT AND FET COST PER TRUCK

	KIT TOTAL PER TRUCK	FET TOTAL PER TRUCK	FET TOTAL PER KIT/TRK	TOTAL PER TRUCK
LMTV CARGO	1.36			1.36
LMTV VAN	0.91			0.91
SUMMATION				
AMBULANCE	1.22	0.00	0.00	1.23
CARGO	1.11	3.64	0.15	4.90
CARGO LWB	1.08	3.78	0.03	4.90
CARGO W/MHE	1.11	4.96	0.09	6.15
CARGO LWB W/MHE	1.06	5.10	0.00	6.16
VAN	0.46	6.78	0.14	7.38
DUMP	1.06	3.97	0.15	5.18
WRECKER	3.72	9.20	0.24	13.16
POL	1.13	5.27	0.01	6.42
TRACTOR	0.41	3.62	0.26	4.29

TABLE C-4. WEIGHTED AVERAGE UPC

UPC	COST x QUANTITY BASE	ALT 1	ALT 2	ALT 3	ALT 4	ALT 5	ALT 6
59.4 LMTV CARGO	1,667,350						
84.9 LMTV VAN	201,838						
UPC WEIGHTED AVERAGE	61.35						
205.2 AMBULANCE	4,720	4,720	4,720	4,720	4,720	4,720	4,720
72.9 CARGO	1,552,953	3,600,668	3,501,308	3,597,023	3,497,663	3,497,663	3,497,663
75.9 CARGO LWB	168,867	168,867	168,867	168,867	168,867	168,867	168,867
98.1 CARGO W/MHE	549,149	549,149	549,149	549,149	549,149	549,149	549,149
100.2 CARGO LWB W/MHE	27,043	27,043	27,043	27,043	27,043	27,043	27,043
132.4 VAN	303,408	618,068	618,068	618,068	618,068	618,068	618,068
79.2 DUMP	635,188	635,188	635,188	635,188	635,188	635,188	635,188
182.2 WRECKER	920,991	920,991	920,991	920,991	920,991	920,991	920,991
104.4 POL	70,376	70,376	70,376	70,376	70,376	70,376	70,376
72.3 TRACTOR	1,587,070	1,587,070	1,587,070	1,587,070	1,587,070	1,587,070	1,587,070
UPC WEIGHTED AVERAGE	86.33	83.59	83.74	83.60	83.75	83.75	83.75
ALT WEIGHTED AVERAGE	83.70						

TABLE C-5. QUANTITIES FOR 130,000 FLEET

130,000 QUANTITIES FOR BASE AND ALT 4

	BASE	ALT 4
LMTV CARGO	53,713	0
LMTV VAN	4,545	0
SUMMATION	58,258	0
AMBULANCE	25	25
CARGO	22,645	73,654
CARGO LWB	2,365	2,365
CARGO W/MHE	5,947	5,947
CARGO LWB W	287	287
VAN	2,436	6,981
DUMP	8,528	8,528
WRECKER	5,375	5,375
POL	716	716
TRACTOR	23,336	23,336
SUMMATION	71,660	127,214
TOTAL	129918	127214

TABLE C-6. WEIGHTED AVERAGE UPC'S FOR 130,000 SENSITIVITY

UPC WEIGHTED AVERAGE
130,000 QUANTITIES FOR BASE AND ALT 4

LMTV CARGO	3,188,265	0
LMTV VAN	385,929	0
UPC WEIGHTED AVERAGE	61.35	0.00
AMBULANCE	5,131	5,131
CARGO	1,650,783	5,369,255
CARGO LWB	179,492	179,492
CARGO W/MHE	583,698	583,698
CARGO LWB W/MHE	28,745	28,745
VAN	322,470	924,124
DUMP	675,254	675,254
WRECKER	979,100	979,100
POL	74,761	74,761
TRACTOR	1,687,053	1,687,053
UPC WEIGHTED AVERAGE	86.33	82.59

Table C-7 presents the cost data input section from the production model. It provides the source data for all UPC's, and fielding costs and inflation factors used in normalizing the data to FY90 constant dollars. Fielding costs are worldwide averages. The model does not develop fielding cost estimates based on an assumed theatre distribution. The remaining paragraphs in this section refer to the process of calculating the additional kit and FET dollars per truck.

2.2 PERSONNEL COST FACTORS

Table C-8 displays the number of assigned drivers per vehicle and the crew cost per vehicle used in the model.

TABLE C-7. SOURCE DATA

VEHICLE	INFL FACTOR	UPC DATA	SOURCE	BASE YEAR $	FIELDING DATA	FIELDING SOURCE	FY90C$ UPC	FY90C$ FIELDING	# OF DRIVERS	CREW COST PER VEHICLE
HMMWV	1.0360	23.70	AMSTA-VCW	FY89C$	2.60	AMSTA-VCW	24.55	2.70	0.10	2.44
CUCV	1.0774	15.60	AMSTA-VCW	FY88C$	2.16	TACOM F&S MDL	16.81	2.32	0.10	2.44
LMTV	1.0360	61.35	SAIC	FY90C$	7.22	FMTV BCE	61.35	7.48	0.10	2.44
MTV	1.0360	86.33	SAIC	FY90C$	10.08	FMTV BCE	86.33	10.44	0.25	6.09
MTV (LMTV)	1.0360	86.33	SAIC	FY90C$	10.08	FMTV BCE	86.33	10.44	0.10	6.09
M101A2 TLR	1.0360	2.45	AMSTA-VCW	FY89C$	0.46	AMSTA-VCW	2.54	0.48	0.00	0.00
M105A2 TRL	1.0360	4.54	AMSTA-VCW	FY89C$	0.89	AMSTA-VCW	4.71	0.92	0.00	0.00
LMTV TLR	1.0360	14.72	AMSTA-VCW	FY89C$	1.60	AMSTA-VCW	15.24	1.66	0.00	0.00
MTV TRL	1.0360	17.37	AMSTA-VCW	FY89C$	2.32	AMSTA-VCW	17.99	2.40	0.00	0.00
5/4 TRL	1.0360	5.90	AMSTA-VCW	FY89C$	0.90	AMSTA-VCW	6.11	0.93	0.00	0.00

TABLE C-8. ASSIGNED DRIVERS AND CREW COST

Costs in FY90 Constant $ (000's)

VEHICLE	# OF ASSIGNED DRIVERS	CREW COST COST PER VEHICLE
HMMWV	0.10	2.44
CUCV	0.10	2.44
LMTV	0.10	2.44
MTV	0.25	6.09
MTV (LMTV)	0.10	6.09
M101A2 TLR	0.00	0.00
M105A2 TRL	0.00	0.00
LMTV TLR	0.00	0.00
MTV TRL	0.00	0.00
5/4 TRL	0.00	0.00

2.3 SUSTAINMENT COST FACTORS

The sustainment cost data presented in Tables C-9 and C-10 orginated with TACOM's Fleet Planning Office. This data was used in the sustainment model to calculate sustainment costs per truck and trailer. All costs are normalized to FY90 constant dollars and expressed each value in thosuands of dollars.

3.0 QUANTITY DATA

The operational analysis for this study provided six alternative vehicle fleets and one baseline fleet to be estimated. The quantity of trucks and trailers by active, reserve, and POMCUS components for each fleet is presented in Tables C-11 through C-14. These data represent the total quantity separated into active, reserve, and POMCUS quantities.

TABLE C-9. SUSTAINMENT COST FACTORS

MODEL OUTPUTS

					SLOPE FACTORS			INTERCEPT VALS
TRANS	SCHD MAINT	MOD KIT	OTHER COSTS	TOTAL CONSTANT	UNSCHED MAINT ($)	DEPOT MAINT AVG $/YR	DEPOT MAINT SLOPE ($/MI/YR)	UNSCHD MAINT INTERCEPT ($/MI)
0.0249	0.1243	0.1212	0.0000	0.2704	0.000024	0.2103	0.000007	0.000128
0.0249	0.2020	0.0684	0.0000	0.2953	0.000016	0.1948	0.000009	0.000117
0.0725	0.2310	0.2258	0.0352	0.5646	0.000079	0.4735	0.000019	0.000322
0.1274	0.2258	0.3098	0.0445	0.7076	0.000097	0.6713	0.000020	0.000341
0.1274	0.2258	0.3098	0.0445	0.7076	0.000097	0.6713	0.000020	0.000341
0.00	0.00	0.00	0.0000	2.40				
0.00	0.00	0.00	0.0000	1.02				
0.00	0.00	0.00	0.0000	1.06				
0.00	0.00	0.00	0.0000	1.90				
0.00	0.00	0.00	0.0000	0.93				

TABLE C-10. SUSTAINMENT COST FACTORS CONTINUED

TOTAL POL ($/MI)	TOTAL ACTIVE ANNUAL MILES	TOTAL RESERVE % OF MILES	SUST % FOR POMCUS	TOTAL SLOPE ($/MI/YR)	TOTAL INTERCEPT ($/MI)	CRT AVG AGE	CURRENT COST ($K/YR)	CURRENT COST ($K/MI)
0.0001	2512	0.70	0.10	0.000032	0.000213	1.37	0.91	0.0004
0.0001	2512	0.70	0.10	0.000025	0.000180	3.90	0.99	0.0004
0.0001	2512	0.70	0.10	0.000098	0.000470	0.00	1.75	0.0007
0.0002	3054	0 70	0.10	0.000117	0.000550	0.00	2.39	0.0008
0.0002	2512	0.70	0.10	0.000117	0.000550	0.00	2.09	0.0008
	4149	0.70	0.10	0.000006	0.000000			
	2512	0.70	0.10	0.000008	0.000000			
	2512	0.70	0.10	0.000007	0.000000			
	3054	0.70	0.10	0.000014	0.000000			
	4149	0.70	0.10	0.000009	0.000000			

TABLE C-11. QUANTITY AND COMPONENT DATA FOR BASELINE

				VEHICLE IDENTIFIER	LIFE	BASELINE FLEET QTY ACTIVE	QTY RESERVE	QTY POMCUS	CUM QTY
1.	HMMWV	T61562	CARGO W/WINCH	M1038	14	0	0	0	0
2.	CUCV	T59346	CARGO W/COMMO	M1008A1	7	0	0	0	0
3.	LMTV	Z40430	CARGO		20	12,510	13,579	4,378	30,467
4.	MTV	Z40439	CARGO		22	0	0	0	0
5.	MTV(LMTV)		CARGO		22	0	0	0	0
6.	TRAILER	W95537	3/4 TON	3/4 TT	30	0	0	0	0
7.	TRAILER	W95881	1 1/2 TON	1 1/2 TT	30	13,036	13,969	4,513	31,518
8.	LMTV TRLR	Z36068	2 1/2 TON LMTV	2 1/2 TT LMTV	30	4,512	4,836	1,562	10,910
9.	MTV TRLR	Z90712	5 TON MTV	5 TT MTV	30	342	367	118	827
10.	TRAILER	X	NEW 5/4 TON	NEW 5/4 TT	30	0	0	0	0

TABLE C-12. QUANTITY AND COMPONENT DATA FOR ALTERNATIVE FLEETS 1 & 2

QUANTITY INPUTS ----->

ALTERN 1 FLEET QTY ACTIVE	QTY RESERVE	QTY POMCUS	CUM QTY	ALTERN 2 FLEET QTY ACTIVE	QTY RESERVE	QTY POMCUS	CUM QTY
0	0	0	0	630	676	218	1,524
0	0	0	0	366	393	127	886
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
12,510	13,579	4,378	30,467	12,036	12,900	4,168	29,104
0	0	0	0	739	791	256	1,786
13,036	13,969	4,513	31,518	12,688	13,595	4,393	30,676
4,512	4,836	1,562	10,910	4,491	4,813	1,555	10,859
342	367	118	827	342	367	118	827
0	0	0	0	0	0	0	0
12,510	13,579	4,378	30,467	12,036	12,900	4,168	29,104

TABLE C-13. QUANTITY AND COMPONENT DATA FOR ALTERNATIVE FLEETS 3 & 4

ALTERN 3 FLEET QTY ACTIVE	QTY RESERVE	QTY POMCUS	CUM QTY	ALTERN 4 FLEET QTY ACTIVE	QTY RESERVE	QTY POMCUS	CUM QTY
0	0	0	0	630	676	218	1,524
0	0	0	0	366	393	127	886
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
12,579	13,482	4,356	30,417	12,016	12,877	4,161	29,054
0	0	0	0	739	791	256	1,786
13,036	13,969	4,513	31.518	12,688	13,595	4,393	30,676
4,512	4,836	1,562	10,910	4,491	4,813	1,555	10,859
342	367	118	827	342	367	118	827
0	0	0	0	0	0	0	0
12,579	13,482	4,356	30,417	12,016	12,877	4,161	29,054

TABLE C-14. QUANTITY AND COMPONENT DATA FOR ALTERNATIVE FLEETS 5 & 6

ALTERN 5 QTY ACTIVE	ALTERN 5 QTY RESERVE	ALTERN 5 FLEET QTY POMCUS	ALTERN 5 CUM QTY	ALTERN 6 QTY ACTIVE	ALTERN 6 QTY RESERVE	ALTERN 6 FLEET QTY POMCUS	ALTERN 6 CUM QTY
549	588	190	1,327	997	1,068	345	2,410
319	342	110	771	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
12,016	12,877	4,161	29,054	12,016	12,877	4,161	29,054
697	747	241	1,685	739	791	256	1,786
12,688	13,595	4,393	30,676	12,688	13,595	4,393	30,676
4,491	4,813	1,555	10,859	4,491	4,813	1,555	10,859
342	367	118	827	342	367	118	827
171	183	59	413	0	0	0	0
12,016	12,877	4,161	29,054	12,016	12,877	4,161	29,054

4.0 TIME PHASING

The objective of this analysis is to develop life cycly cost estimates for each vehicle fleet covering a period of thirty fiscal years. In order to maintain consistency with the truck modification plan, production starts in FY90 and is extended until FY2020. The fielding phase is developed from the production phase with a one year lag applied. The first FMTV vehicle fielding begins in FY91. The sustainment phase begins with the first fielding year and extends to FY2020.

A time phasing sensitivity analysis was performed. The objective was to determine how many additional years are required in the production phase to buy out the total quantity of vehicles in the baseline (97,880) and each altenative fleet and to calculate the additional dollars required. An annual dollar constraint was imposed over the entire production phase. The constraint was develped from the production model using 97,880 vehicles wihout rebuys. The result of this sensitivity was an additional one year of vehicle production.

5.0 MODELING PROCESS

5.1 PRODUCTION MODEL

The Truck LCC model calculates the production and fielding costs for each fleet life cycle cost estimate. This model contains all the basic quantity and cost data described in Section 2 of this annex.

The vehicle quantities for the baseline and each fleet mix were developed as a result of the substitution methodology. LMTV and MTV quantities per year were taken from the truck modification plan and input into the production model. This data, representing annual production quantities, did not include annual quantity projections for trailers. Therefore, the formulas were developed to calculate the annual trailer quantities based on the baseline MTV and LMTV annual production quantities. Tables C-11 thru C-14 provide the basic quantity data.

The Truck LCC next calculated a produciton schedule for each fleet based upon the annual production quantities for the LMTV and MTV. Since the study period covers thirty years and vehicle lives vary from 7 to 22 years, the requirement for vehicle rebuys was calculated to quantify the total requirement to field a fleet of 97,880 vehicles by FY2020.

The next step is the calculation of the production quantities with rebuys for the chosen option. As an example, the first rebuy for the LMTV trucks occurs in FY12. The quantity in FY12 equals 1,472. It is the sum of the production quantity of 737 for FY12 plus the rebuy quantity of 735 for FY92.

Fielding quantities are calculated next using the annual production quantities. As an assumption, we employed a one year lag for fielding all trucks and trailers. Fielding costs are then multiplied by the annual fielding quantities to calculate annual fielding costs.

Annual production total costs are calculated by multiplying the total annual production quantity by each vehicle's UPC. This produces the annual production costs for the entire life cycle.

The final step within the Truck LCC model is the calculation of the production residual value. The annual residual value is a calculation of percent of life remaining for each vehicle times its UPC. The formula is:

[(VEHICLE LIFE - AGA) / VEHICLE LIFE] x UPC

5.2 SUSTAIMMENT MODEL

The first step in the sustainment model is the importation of the sustainment data from the Truck LCC model. These data, identified earlier are presented in Section 2 of this annex and are used to calculate a sustainment cost/vehicle/year.

The sustainment model next imports the fielding quantities calculated in the Truck LCC model. The fielded quantities imported include production rebuys and are not broken out by active, reserve, and POMCUS vehicles. A breakout of the fielding quantities into active, reserve, and POMCUS is conducted within the sustainment model. The time phased distribution of vehicles covers the entire life cycle from FY91 to FY2020 and was designed to follow a pattern of all active vehicles fielded first, followed by reserve vehicles and POMCUS vehicles. The separation of fielding quantities into these three components is done to satisfy a major assumption in the model. That is, all active vehicles are estimated at 100% of the annual calculated sustainment costs. Reserve vehicles are estimated at 70 percent of the active sustainment annual cost and POMCUS vehicles are estimated at 10 percent of the active sustainment annual cost.

The next step in the sustainment model is the calculation of the sustainment dollars per vehicle per year for active vehicles. The formula used for this purpose is presented below.

ANNUAL SUSTAINMENT COST = ((SLOPE*AGE +INTERCEPT)*ANNUAL MILES) + FIXED ANNUAL COST + (CREW P&A * # OF ASSIGNED DRIVERS)

This formula expresses the annual sustainment cost per vehicle as a linear function of vehicle age and annual miles driven. The formula's parameters are discussed below.

Fixed annual costs are those costs which will not vary with vehicle age or annual mileage. These costs include scheduled maintenance, war reserve OMA/ASF repair parts, war reserve procurement spares, maintenance related transportation costs, modification kits, and "Other Sustainment".

The intercept includes costs for POL (petroleum, oil, and lubricants) and is a function of annual miles driven.

The slope measures the annual cost of unscheduled maintenance (man hours and parts).

The model calculates the sustainment dollars per vehicle per year for reserve vehicles using the 70% factor. The .70 factor is an average factor based on meduim truck usage graphical displays from the truck modernization plan.

POMCUS sustainment dollars per vehicle per year are calculated next using the 10% factor of the active sustainment dollars per vehicle per year.

The last step in the sustainment model is the calculation of total sustainment dollars by year for active, reserve, and POMCUS vehicles. The totals are calculated based on quantities in the current year and their ages. The total sustainment dollar cost by year is the summation of sustainment dollar cost by year for active, reserve, and POMCUS vehicles.

5.3 INFLATION MODEL

Current year dollar projections are calculated for each fleet using AMC inflation guidance dated. Annual production dollars are inflated using "Other Procurement" base year FY90 composite indices. Annual fielding dollars and sustainment dollars are inflated using "OMA" base year FY90 composite indices.

5.4 MODEL OUTPUTS

The Truck LCC and sustainment cost model outputs for the base line and each alternative fleet, are attached in their entirety. In addition, graphical displays for cumulative life cycle cost estimates in current year dollars are provided.

5.4.1 Production and Fielding Model Outputs for Baseline Fleet.

Table C-15 presents the baseline production quantities. Table C-16 presents the baseline production quantities with rebuys. Table C-17 presents the baseline production dollars for the fleet including rebuys. Table C-18 presents the baseline fielding quantities. Table C-19 present the baseline fielding dollars. Table C-20 presents the baseline residual value.

5.4.2 Sustainment Model Outputs for Baseline Fleet.

Table C-21 presents the active quantities for sustainment. Table C-22 presents the active vehicle dollars/vehicle by age for sustainment. Table C-23 presents the active vehicle cost per year for sustainment.

Table C-24 presents the reserve quantities for sustainment. Table C-25 presents the reserve vehicle dollars/vehicle by age for sustainment. Table C-26 presents the reserve vehicle cost per year for sustainment.

Table C-27 presents the POMCUS quantities for sustainment. Table C-28 presents the reserve vehicle dollars/vehicle by age for sustainment. Table C-29 presents the reserve vehicle cost per year for sustainment.

Table C-30 presents the total sustainment cost for all vehicles.

5.4.3 Constant Year Summary for Baseline and all Alternatives.

Table C-31 presents the life cycle cost by cost phase for the baseline and each alternative. Table C-32 presents the cumulative life cycle cost for the baseline. Table C-33 presents the cumulative life cycle cost for Alternative 1. Table C-34 presents the cumulative life cycle cost for Alternative 2. Table C-35 presents the cumulative life cycle cost for Alternative 3. Table C-36 presents the cumulative life cycle cost for Alternative 4. Table C-37 presents the cumulative life cycle cost for Alternative 5. Table C-38 presents the cumulative life cycle cost for Alternative 6.

5.4.4 Current Year Summary for Baseline and all Alternatives.

Current year dollar projections are calculated for each fleet using AMC inflation guidance dated January 31, 1989. Annual production dollars are inflated using "Other Procurement" base year FY90 composite indices. Annual fielding dollars and sustainment dollars are inflated using "OMA" base year FY90 composite indices.

Table C-39 presents the life cycle cost by cost phase for the baseline and each alternative in current dollars. Table C-40 presents the cumulative life cycle cost for the baseline in current dollars. Table C-41 presents the cumulative life cycle cost for Alternative 1 in current dollars. Table C-42 presents the cumulative life cycle cost for Alternative 2 in current dollars. Table C-43 presents the cumulative life cycle cost for Alternative 3 in current dollars. Table C-44 presents the cumulative life cycle cost for Alternative 4 in current dollars. Table C-45 presents the cumulative life cycle cost for Alternative 5 in current dollars. Table C-46 presents the cumulative life cycle cost for Alternative 6 in current dollars.

TABLE C-15. BASELINE PRODUCTION QUANTITIES

THROUGHPUT
BASELINE PRODUCTION QUANTITIES

	FY90	FY91	FY92	FY93	FY94	FY95	FY96	FY97	FY98	FY99	FY00	FY01	FY02	FY03	FY04	FY05	FY06
1 HMMWV	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2 CUCV	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3 LMTV	0	0	735	1,471	1,471	1,471	1,663	1,663	0	0	0	0	573	1,147	1,147	1,338	1,338
4 MTV	0	837	2,012	3,092	3,092	3,859	3,840	2,254	0	0	0	0	1,339	2,676	2,676	3,122	3,122
5 MTV(LMTV)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6 M101A2 TRLR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7 M105A2 TRLR	0	269	886	1,469	1,469	1,716	1,772	1,262	0	0	0	0	615	1,232	1,231	1,436	1,436
8 LMTV TRLR	0	93	306	509	508	594	614	436	0	0	0	0	213	427	426	497	497
9 MTV TRLR	0	7	23	38	39	45	46	34	0	0	0	0	16	32	32	38	38
10 5/4 TRAILER	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LMTV SPREAD	0.00	0.00	0.02	0.05	0.05	0.05	0.05	0.05	0.00	0.00	0.00	0.00	0.02	0.04	0.04	0.04	0.04
TRUCK TOTAL		837	2747	4563	4563	5330	5503	3917	0	0	0	0	1912	3823	3823	4460	4460

	FY07	FY08	FY09	FY10	FY11	FY12	FY13	FY14	FY15	FY16	FY17	FY18	FY19	FY20	TOTAL
1 HMMWV	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2 CUCV	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3 LMTV	764	956	956	2,076	1,708	737	956	1,147	1,797	1,338	574	955	1,147	1,338	30467
4 MTV	1,784	2,230	2,230	3,867	3,566	1,205	2,230	2,676	3,506	3,122	1,048	2,230	2,676	3,122	67413
5 MTV(LMTV)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6 M101A2 TRLR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7 M105A2 TRLR	820	1,026	1,026	1,914	1,698	625	1,026	1,231	1,708	1,436	522	1,026	1,231	1,437	31518
8 LMTV TRLR	284	355	355	663	587	217	355	426	591	497	181	355	426	498	10910
9 MTV TRLR	21	27	27	50	45	16	27	32	45	38	14	27	32	38	827
10 5/4 TRAILER	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LMTV SPREAD	0.03	0.03	0.03	0.07	0.06	0.02	0.03	0.04	0.06	0.04	0.02	0.03	0.04	0.04	1.00
TRUCK TOTAL	2548	3186	3186	5943	5274	1942	3186	3823	5303	4460	1622	3186	3823	4460	97880

TABLE C-16. BASELINE PRODUCTION QUANTITIES WITH REBUYS

CALCULATION OF CHOSEN OPTION AND REBUYS
BASELINE PRODUCTION QUANTITIES

	1 FY90	2 FY91	3 FY92	4 FY93	5 FY94	6 FY95	7 FY96	8 FY97	9 FY98	10 FY99	11 FY00	12 FY01	13 FY02	14 FY03	15 FY04	16 FY05	17 FY06
1 HMMWV	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2 CUCV	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3 LMTV	0	0	735	1,471	1,471	1,471	1,663	1,663	0	0	0	0	573	1,147	1,147	1,338	1,338
4 MTV	0	837	2,012	3,092	3,092	3,859	3,840	2,254	0	0	0	0	1,339	2,676	2,676	3,122	3,122
5 MTV(LMTV)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6 M101A2 TRLR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7 M105A2 TRLR	0	269	886	1,469	1,469	1,716	1,772	1,262	0	0	0	0	615	1,232	1,231	1,436	1,436
8 LMTV TRLR	0	93	306	509	508	594	614	436	0	0	0	0	213	427	426	497	497
9 MTV TRLR	0	7	23	38	39	45	46	34	0	0	0	0	16	32	32	38	38
10 5/4 TRAILER	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MTV TOTAL	0	837	2,012	3,092	3,092	3,859	3,840	2,254	0	0	0	0	1,339	2,676	2,676	3,122	3,122

	18 FY07	19 FY08	20 FY09	21 FY10	22 FY11	23 FY12	24 FY13	25 FY14	26 FY15	27 FY16	28 FY17	29 FY18	30 FY19	31 FY20	TOTAL
1 HMMWV	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2 CUCV	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3 LMTV	764	956	956	2,076	1,708	1,472	2,427	2,618	3,268	3,001	2,237	956	1,147	1,338	38,941
4 MTV	1,784	2,230	2,230	3,867	3,566	1,205	3,067	4,688	6,598	6,214	4,907	6,070	4 930	3,122	86,399
5 MTV(LMTV)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6 M101A2 TRLR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7 M105A2 TRLR	820	1,026	1,026	1,914	1,698	625	1,026	1,231	1,708	1,436	522	1,026	1,231	1,437	31,518
8 LMTV TRLR	284	355	355	663	587	217	355	426	591	497	181	355	426	498	10,910
9 MTV TRLR	21	27	27	50	45	16	27	32	45	38	14	27	32	38	827
10 5/4 TRAILER	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	1,784	2,230	2,230	3,867	3,566	1,205	3,067	4,688	6,598	6,214	4,907	6,070	4,930	3,122	86,399

TABLE C-17. BASELINE PRODUCTION DOLLARS WITH REBUYS

CALCULATION BASED PRODUCTION QUANTITIES TIMES UPC
BASELINE PRODUCTION DOLLARS IN FY90 CONSTANT $

	FY90	FY91	FY92	FY93	FY94	FY95	FY96	FY97	FY98	FY99	FY00	FY01	FY02	FY03	FY04	FY05	FY06
1 HMMWV	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2 CUCV	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3 LMTV	0	0	45,083	90,248	90,248	90,248	102,027	102,027	0	0	0	0	35,154	70,370	70,370	82,088	82,088
4 MTV	0	72,258	173,696	266,932	266,932	333,148	331,507	194,588	0	0	0	0	115,596	231,019	231,019	269,522	269,522
5 MTV(LMTV)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6 M101A2 TRLR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7 M105A2 TRLR	0	1,266	4,166	6,915	6,915	8,078	8,342	5,941	0	0	0	0	2,895	5,800	5,795	6,760	6,760
8 LMTV TRLR	0	1,418	4,665	7,760	7,744	9,055	9,360	6,647	0	0	0	0	3,247	6,510	6,494	7,577	7,577
9 MTV TRLR	0	126	414	684	702	810	828	612	0	0	0	0	288	576	576	684	684
10 5/4 TRAILER	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PROD TOTAL	0	75,068	228,034	372,539	372,542	441,338	452,064	309,814	0	0	0	0	157,180	314,274	314,254	366,631	366,631

	FY07	FY08	FY09	FY10	FY11	FY12	FY13	FY14	FY15	FY16	FY17	FY18	FY19	FY20	TOTAL	RESIDUAL VALUE	TOTAL LESS RESIDUAL
1 HMMWV	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2 CUCV	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3 LMTV	46,872	58,652	58,652	127,365	104,788	90,309	148,599	160,618	200,496	184,115	137,243	58,652	70,370	82,088	2,389,078	1,093,587	1,295,491
4 MTV	154,015	192,516	192,516	333,838	307,863	104,028	264,774	404,715	569,605	535,455	423,621	524,023	425,607	269,522	7,458,828	3,736,958	3,721,870
5 MTV(LMTV)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6 M101A2 TRLR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7 M105A2 TRLR	3,860	4,830	4,830	9,010	7,993	2,942	4,830	5,795	8,041	6,760	2,457	4,830	5,795	6,765	148,374	79,112	69,262
8 LMTV TRLR	4,330	5,412	5,412	10,107	8,949	3,308	5,412	6,494	9,010	7,577	2,759	5,412	6,494	7,592	166,320	88,686	77,634
9 MTV TRLR	378	486	486	900	810	288	486	576	810	684	252	486	576	684	14,879	7,940	6,939
10 5/4 TRAILER	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PROD TOTAL	209,453	261,895	261,895	491,220	430,392	200,875	424,401	578,198	787,961	735,590	566,333	593,403	508,842	366,651	10,177,478	5,006,282	5,171,196

TABLE C-18. BASELINE FIELDING QUANTITIES

CALCULATION BASED PRODUCTION QUANTITIES W/ 1 YEAR LAG

BASELINE FIELDING QUANTITIES

	FY90	FY91	FY92	FY93	FY94	FY95	FY96	FY97	FY98	FY99	FY00	FY01	FY02	FY03	FY04	FY05	FY06
1 HMMWV		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2 CUCV		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3 LMTV		0	0	735	1,471	1,471	1,471	1,663	1,663	0	0	0	0	573	1,147	1,147	1,338
4 MTV		0	837	2,012	3,092	3,092	3,859	3,840	2,254	0	0	0	0	1,339	2,676	2,676	3,122
5 MTV(LMTV)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6 M101A2 TRLR		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7 M105A2 TRLR		0	269	885	1,469	1,469	1,716	1,772	1,262	0	0	0	0	615	1,232	1,231	1,436
8 LMTV TRLR		0	93	306	509	508	594	614	436	0	0	0	0	213	427	426	497
9 MTV TRLR		0	7	23	38	39	45	46	34	0	0	0	0	16	32	32	33
10 5/4 TRAILER		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TRUCK TOTAL	0	0	837	2,747	4,563	4,563	5,330	5,503	3,917	0	0	0	0	1,912	3,823	3,823	4,460

	FY07	FY08	FY09	FY10	FY11	FY12	FY13	FY14	FY15	FY16	FY17	FY18	FY19	FY20	TOTAL
1 HMMWV	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2 CUCV	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3 LMTV	1,338	764	956	956	2,076	1,708	1,472	2,427	2,618	3,268	3,001	2,237	956	1,147	37,603
4 MTV	3,122	1,784	2,230	2,230	3,867	3,566	1,205	3,067	4,688	6,598	6,214	4,907	6,070	4,930	83,277
5 MTV(LMTV)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6 M101A2 TRLR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7 M105A2 TRLR	1,436	820	1,026	1,026	1,914	1,698	625	1,026	1,231	1,708	1,436	522	1,026	1,231	30,081
8 LMTV TRLR	497	284	355	355	663	587	217	355	426	591	497	181	355	426	10,412
9 MTV TRLR	38	21	27	27	50	45	16	27	32	45	38	14	27	32	789
10 5/4 TRAILER	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TRUCK TOTAL	4,460	2,548	3,186	3,186	5,943	5,274	2,677	5,494	7,306	9,866	9,215	7,144	7,026	6,077	120880

TABLE C-19. BASELINE FIELDING DOLLARS

CALCULATION BASED FIELDED QUANTITIES TIMES UPC
BASELINE FIELDING DOLLARS IN FY90 CONSTANT $

	FY90	FY91	FY92	FY93	FY94	FY95	FY96	FY97	FY98	FY99	FY00	FY01	FY02	FY03	FY04	FY05	FY06
1 HMMWV	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2 CUCV	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3 LMTV	0	0	0	5,495	10,997	10,997	10,997	12,432	12,432	0	0	0	0	4,284	8,575	8,575	10,003
4 MTV	0	0	8,738	21,005	32,280	32,280	40,287	40,089	23,531	0	0	0	0	13,979	27,937	27,937	32,593
5 MTV(LMTV)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6 M10142 TRLR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7 M105A2 TRLR	0	0	248	816	1,354	1,354	1,582	1,634	1,164	0	0	0	0	567	1,136	1,135	1,324
8 LMTV TRLR	0	0	154	507	843	841	983	1,016	722	0	0	0	0	353	707	705	823
9 MTV TRLR	0	0	17	55	91	94	108	110	82	0	0	0	0	38	77	77	91
10 5/4 TRAILER	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0
FIELD TOTAL	0	0	9,157	27,877	45,565	45,566	53,958	55,282	37,931	0	0	0	0	19,221	38,431	38,429	44,834

	FY07	FY08	FY09	FY10	FY11	FY12	FY13	FY14	FY15	FY16	FY17	FY18	FY19	FY20	TOTAL
1 HMMWV	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2 CUCV	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3 LMTV	10,003	5,711	7,147	7,147	15,520	12,769	11,004	18,144	19,572	24,431	22,435	16,723	7,147	8,575	281,112
4 MTV	32,593	18,625	23,281	23,281	40,371	37,228	12,580	32,019	48,942	68,882	64,873	51,228	63,369	51,468	869,393
5 MTV(LMTV)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6 M101A2 TRLR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7 M105A2 TRLR	1,324	756	946	946	1,765	1,566	576	946	1,135	1,575	1,324	481	946	1,135	27,736
8 LMTV TRLR	823	470	588	588	1,098	972	359	588	705	978	823	300	588	705	17,237
9 MTV TRLR	91	50	65	65	120	108	38	65	77	108	91	34	65	77	1,895
10 5/4 TRAILER	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	44,834	25,613	32,026	32,026	58,873	52,642	24,558	51,761	70,430	95,974	89,546	68,766	72,115	61,960	1,197,372

TABLE C-20. BASELINE RESIDUAL VALUE

RESIDUAL VALUE

BASELINE (PERCENTAGE OF LIFE LEFT x PRODUCTION QTY x UPC)

	31 FY90	30 FY91	29 FY92	28 FY93	27 FY94	26 FY95	25 FY96	24 FY97	23 FY98	22 FY99	21 FY00	20 FY01	19 FY02	18 FY03	17 FY04	16 FY05	15 FY06
1 HMMWV	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2 CUCV	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3 LMTV	0	0	0	0	0	0	0	0	0	0	0	0	2,637	8,796	12,315	18,470	22,574
4 MTV	0	0	0	0	0	0	0	0	0	0	0	0	18,390	47,254	57,755	79,632	91,883
5 MTV(LMTV)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6 M101A2 TRLR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7 M105A2 TRLR	0	21	208	576	807	1,212	1,529	1,287	0	0	0	0	1,110	2,417	2,608	3,267	3,493
8 LMTV TRLR	0	24	233	647	904	1,358	1,716	1,440	0	0	0	0	1,245	2,712	2,922	3,662	3,915
9 MTV TRLR	0	2	21	57	82	121	152	133	0	0	0	0	110	240	259	330	353
10 5/4 TRAILER	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	47	462	1,280	1,792	2,691	3,397	2,860	0	0	0	0	23,492	61,419	75,869	105,361	122,217

	14 FY07	13 FY08	12 FY09	11 FY10	10 FY11	9 FY12	8 FY13	7 FY14	6 FY15	5 FY16	4 FY17	3 FY18	2 FY19	1 FY20	TOTAL
1 HMMWV	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2 CUCV	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3 LMTV	15,234	21,994	24,927	60,498	55,014	51,928	93,062	108,417	145,359	142,689	113,225	51,320	65,092	80,036	1,093,587
4 MTV	59,505	83,132	91,883	174,506	174,916	63,836	174,510	285,140	427,204	426,725	356,227	464,475	396,588	263,397	3,736,958
5 MTV(LMTV)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6 M101A2 TRLR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7 M105A2 TRLR	2,123	2,817	2,978	5,867	5,462	2,109	3,622	4,539	6,566	5,746	2,171	4,427	5,505	6,652	79,112
8 LMTV TRLR	2,381	3,157	3,337	6,570	6,115	2,371	4,059	5,087	7,358	6,440	2,437	4,961	6,170	7,466	88,686
9 MTV TRLR	208	283	300	585	553	206	364	451	661	581	222	445	547	672	7,940
10 5/4 TRAILER	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	79,461	111,384	123,425	248,016	242,060	120,449	275,618	403,635	587,149	582,182	474,283	525,629	473,902	358,222	5,006,282

TABLE C-21. ACTIVE QUANTITIES FOR SUSTAINMENT

CALCULATION OF ACTIVE VEHICLE QUANTITIES

ACTIVE FIELDED QUANTITIES FOR SUSTAINMENT

	FY90	FY91	FY92	FY93	FY94	FY95	FY96	FY97	FY98	FY99	FY00	FY01	FY02	FY03	FY04	FY05	FY06
1 HMMWV	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2 CUCV	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3 LMTV	0	0	0	735	1,471	1,471	1,471	1,663	1,663	0	0	0	0	573	1,147	1,147	1,338
4 MTV	0	0	837	2,012	3,092	3,092	3,859	3,840	2,254	0	0	0	0	1,339	2,676	2,676	3,122
5 MTV(LMTV)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6 M101A2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7 M105A2	0	0	269	885	1,469	1,469	1,716	1,772	1,262	0	0	0	0	615	1,232	1,231	522
8 LMTV TRLR	0	0	93	306	509	508	594	614	436	0	0	0	0	213	427	426	180
9 MTV TRLR	0	0	7	23	38	39	45	46	34	0	0	0	0	16	32	32	14
10 5/4 TRLR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TRUCK TOTAL	0	0	837	2,747	4,563	4,563	5,330	5,503	3,917	0	0	0	0	1,912	3,823	3,823	4,460

	FY07	FY08	FY09	FY10	FY11	FY12	FY13	FY14	FY15	FY16	FY17	FY18	FY19	FY20	TOTAL
1 HMMWV	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2 CUCV	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3 LMTV	1,338	764	659	(0)	0	0	0	0	0	0	0	0	0	0	15,440
4 MTV	3,122	1,784	754	(0)	0	0	0	0	0	0	0	0	0	0	34,459
5 MTV(LMTV)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6 M101A2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7 M105A2	(0)	0	0	0	0	0	0	0	0	0	0	0	0	0	12,442
8 LMTV TRLR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4,306
9 MTV TRLR	(0)	0	0	0	0	0	0	0	0	0	0	0	0	0	326
10 5/4 TRLR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TRUCK TOTAL	4,460	2,548	1,414	(0)	0	0	0	0	0	0	0	0	0	0	49,900

TABLE C-22. ACTIVE VEHICLE DOLLARS/VEHICLE BY AGE FOR SUSTAINMENT

CALCULATION OF UNIT O&M COST FOR ACTIVE VEHICLES

ACTIVE VEHICLES O&M DOLLARS/VEHICLE BY AGE

	1 FY90	2 FY91	3 FY92	4 FY93	5 FY94	6 FY95	7 FY96	8 FY97	9 FY98	10 FY99	11 FY00	12 FY01	13 FY02	14 FY03	15 FY04	16 FY05	17 FY06
1 HMMWV	1.13	1.21	1.29	1.37	1.45	1.53	1.61	1.69	1.77	1.84	1.92	2.00	2.08	2.16	0.00	0.00	0.00
2 CUCV	1.06	1.12	1.18	1.24	1.30	1.37	1.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3 LMTV	2.23	2.48	2.73	2.97	3.22	3.46	3.71	3.95	4.20	4.45	4.69	4.94	5.18	5.43	5.68	5.92	6.17
4 MTV	4.27	4.63	4.98	5.34	5.70	6.06	6.42	6.77	7.13	7.49	7.85	8.21	8.56	8.92	9.28	9.64	10.00
5 MTV(LMTV)	2.63	2.92	3.22	3.51	3.80	4.10	4.39	4.69	4.98	5.28	5.57	5.87	6.16	6.45	6.75	7.04	7.34
6 TRAILER	2.41	2.42	2.44	2.45	2.46	2.48	2.49	2.51	2.52	2.53	2.55	2.56	2.57	2.59	2.60	2.62	2.63
7 TRAILER	1.04	1.06	1.08	1.10	1.12	1.14	1.16	1.18	1.20	1.22	1.24	1.26	1.28	1.30	1.32	1.34	1.36
8 LMTV TRLR	1.08	1.10	1.12	1.13	1.15	1.17	1.19	1.20	1.22	1.24	1.26	1.28	1.29	1.31	1.33	1.35	1.36
9 MTV TRLR	1.94	1.98	2.03	2.07	2.12	2.16	2.20	2.25	2.29	2.34	2.38	2.43	2.47	2.51	2.56	2.60	2.65
10 TRAILER	0.95	0.98	1.00	1.02	1.04	1.06	1.09	1.11	1.13	1.15	1.18	1.20	1.22	1.24	1.26	1.29	1.31

	18 FY07	19 FY08	20 FY09	21 FY10	22 FY11	23 FY12	24 FY13	25 FY14	26 FY15	27 FY16	28 FY17	29 FY18	30 FY19	31 FY20	TOTAL
1 HMMWV	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	23
2 CUCV	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9
3 LMTV	6.41	6.66	6.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	91
4 MTV	10.35	10.71	11.07	11.43	11.79	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	177
5 MTV(LMTV)	7.63	7.93	8.22	8.52	8.81	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	126
6 M101A2	2.64	2.66	2.67	2.69	2.70	2.71	2.73	2.74	2.75	2.77	2.78	2.80	2.81	0.00	78
7 M105A2	1.38	1.40	1.42	1.44	1.46	1.48	1.50	1.52	1.54	1.56	1.58	1.60	1.62	0.00	40
8 LMTV TRLR	1.38	1.40	1.42	1.44	1.45	1.47	1.49	1.51	1.52	1.54	1.56	1.58	1.60	0.00	40
9 MTV TRLR	2.69	2.73	2.78	2.82	2.87	2.91	2.96	3.00	3.04	3.09	3.13	3.18	3.22	0.00	77
10 5/4 TRLR	1.33	1.35	1.38	1.40	1.42	1.44	1.46	1.49	1.51	1.53	1.55	1.58	1.60	0.00	38

TABLE C-23. ACTIVE VEHICLE COST PER YEAR FOR SUSTAINMENT

CALCULATION OF TOTAL O&M COST FOR ACTIVE VEHICLES

ACTIVE VEHICLES TOTAL O&M DOLLARS/YEAR

	1 FY90	2 FY91	3 FY92	4 FY93	5 FY94	6 FY95	7 FY96	8 FY97	9 FY98	10 FY99	11 FY00	12 FY01	13 FY02	14 FY03	15 FY04	16 FY05	17 FY06
1 HMMWV	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2 CUCV	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3 LMTV	0	0	0	1,64[illegible]	5,110	8,939	13,130	18,111	23,501	25,584	27,666	29,749	31,831	35,194	39,980	45,049	50,826
4 MTV	0	0	3,572	12,468	26,674	41,997	61,700	82,704	98,313	105,110	111,907	118,704	125,501	138,013	156,710	176,365	198,881
5 MTV(LMTV)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6 M101A2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7 M105A2	0	0	278	1,200	2,743	4,316	6,175	8,125	9,583	9,760	9,937	10,114	10,292	11,105	12,570	14,058	14,837
8 LMTV TRLR	0	0	100	432	989	1,554	2,220	2,919	3,437	3,491	3,545	3,600	3,654	3,939	4,468	4,984	5,251
9 MTV TRLR	0	0	14	58	133	212	304	400	475	486	495	505	516	557	630	704	746
10 5/4 TRLR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	3,965	15,792	35,651	57,019	83,529	112,259	135,309	144,430	153,551	162,673	171,794	188,808	214,348	241,159	270,540

	18 FY07	19 FY08	20 FY09	21 FY10	22 FY11	23 FY12	24 FY13	25 FY14	26 FY15	27 FY16	28 FY17	29 FY18	30 FY19	31 FY20	TOTAL
1 HMMWV	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2 CUCV	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3 LMTV	56,931	62,083	67,188	70,983	74,777	78,571	77,111	70,208	62,943	55,317	45,956	36,187	37,899	39,611	1,192,079
4 MTV	222,515	241,566	256,842	269,179	281,515	293,852	306,188	308,360	295,964	269,732	242,393	204,633	165,722	144,696	4,961,759
5 MTV(LMTV)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6 M101A2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7 M106A2	15,086	15,335	15,585	15,834	16,083	16,332	16,582	16,831	17,080	17,329	17,579	17,828	18,077	18,326	358,980
8 LMTV TRLR	5,328	5,404	5,481	5,558	5,634	5,711	5,787	5,864	5,940	6,017	6,093	6,170	6,246	6,323	126,130
9 MTV TRLR	760	775	789	804	818	832	847	861	876	890	904	919	933	948	18,192
10 5/4 TRLR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

TABLE C-24. RESERVE QUANTITIES FOR SUSTAINMENT

CALCULATION OF RESERVE VEHICLE QUANTITIES

RESERVE FIELDED QUANTITIES FOR SUSTAINMENT

	FY90	FY91	FY92	FY93	FY94	FY95	FY96	FY97	FY98	FY99	FY00	FY01	FY02	FY03	FY04	FY05	FY06
1 HMMWV	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2 CUCV	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3 LMTV	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4 MTV	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5 MTV(LMTV)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6 TRAILER	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7 TRAILER	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	914
8 LMTV TRLR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	317
9 MTV TRLR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	24
10 TRAILER	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TRUCK TOTAL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

	FY07	FY08	FY09	FY10	FY11	FY12	FY13	FY14	FY15	FY16	FY17	FY18	FY19	FY20	TOTAL
1 HMMWV	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2 CUCV	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3 LMTV	0	0	297	956	2,076	1,708	1,472	2,427	2,618	3,268	1,938	(0)	0	0	16,759
4 MTV	0	0	1,476	2,230	3,867	3,566	1,205	3,067	4,688	6,598	6,214	3,984	0	0	36,894
5 MTV(LMTV)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6 M101A2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7 M105A2	1,436	820	1,026	1,026	1,914	1,698	625	1,026	1,231	1,616	(0)	0	0	0	13,332
8 LMTV TRLR	497	284	355	355	663	587	217	355	426	559	(0)	0	0	0	4,615
9 MTV TRLR	38	21	27	27	50	45	16	27	32	43	(0)	0	0	0	350
10 5/4 TRLR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TRUCK TOTAL	0	0	1,772	3,186	5,943	5,274	2,677	5,494	7,306	9,866	8,152	3,984	0	0	53,654

TABLE C-25. RESERVE VEHICLE DOLLARS/VEHICLE BY AGE FOR SUSTAINMENT

CALCULATION OF UNIT O&M COST FOR RESERVE VEHICLES

RESERVE VEHICLES O&M DOLLARS/VEHICLE BY AGE

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
	FY90	FY91	FY92	FY93	FY94	FY95	FY96	FY97	FY98	FY99	FY00	FY01	FY02	FY03	FY04	FY05	FY06
1 HMMWV	0.94	1.00	1.06	1.11	1.17	1.22	1.28	1.33	1.39	1.45	1.50	1.56	1.61	1.67	0.00	0.00	0.00
2 CUCV	0.90	0.94	0.99	1.03	1.07	1.12	1.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3 LMTV	1.81	1.98	2.15	2.32	2.49	2.67	2.84	3.01	3.18	3.35	3.53	3.70	3.87	4.04	4.22	4.39	4.56
4 MTV	3.66	3.91	4.16	4.41	4.66	4.91	5.16	5.41	5.66	5.91	6.16	6.41	6.66	6.91	7.17	7.42	7.67
5 MTV(LMTV)	2.12	2.33	2.54	2.74	2.95	3.15	3.36	3.57	3.77	3.98	4.19	4.39	4.60	4.80	5.01	5.22	5.42
6 TRAILER	2.40	2.41	2.42	2.43	2.44	2.45	2.46	2.47	2.48	2.49	2.50	2.51	2.52	2.53	2.54	2.55	2.56
7 TRAILER	1.03	1.04	1.06	1.07	1.09	1.10	1.11	1.13	1.14	1.16	1.17	1.18	1.20	1.21	1.23	1.24	1.25
8 LMTV TRLR	1.07	1.09	1.10	1.11	1.12	1.14	1.15	1.16	1.17	1.19	1.20	1.21	1.22	1.24	1.25	1.26	1.27
9 MTV TRLR	1.93	1.96	1.99	2.02	2.05	2.08	2.11	2.14	2.17	2.20	2.24	2.27	2.30	2.33	2.36	2.39	2.42
10 TRAILER	0.95	0.96	0.98	0.99	1.01	1.02	1.04	1.06	1.07	1.09	1.10	1.12	1.13	1.15	1.16	1.18	1.20

	18	19	20	21	22	23	24	25	26	27	28	29	30	31	
	FY07	FY08	FY09	FY10	FY11	FY12	FY13	FY14	FY15	FY16	FY17	FY18	FY19	FY20	TOTAL
1 HMMWV	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	18
2 CUCV	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7
3 LMTV	4.73	4.90	5.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	69
4 MTV	7.92	8.17	8.42	8.67	8.92	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	138
5 MTV(LMTV)	5.63	5.83	6.04	6.25	6.45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	94
6 M101A2	2.57	2.58	2.59	2.60	2.61	2.62	2.63	2.64	2.65	2.66	2.67	2.68	2.69	0.00	76
7 M105A2	1.27	1.28	1.30	1.31	1.32	1.34	1.35	1.37	1.38	1.39	1.41	1.42	1.44	0.00	37
8 LMTV TRLR	1.29	1.30	1.31	1.32	1.34	1.35	1.36	1.37	1.39	1.40	1.41	1.42	1.44	0.00	38
9 MTV TRLR	2.45	2.48	2.51	2.54	2.58	2.61	2.64	2.67	2.70	2.73	2.76	2.79	2.82	0.00	71
10 5/4 TRLR	1.21	1.23	1.24	1.26	1.27	1.29	1.30	1.32	1.34	1.35	1.37	1.38	1.40	0.00	35

TABLE C-26. RESERVE VEHICLE COST PER YEAR FOR SUSTAINMENT

CALCULATION OF TOTAL O&M COST FOR RESERVE VEHICLES

RESERVE VEHICLES TOTAL O&M DOLLARS/YEAR

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
	FY90	FY91	FY92	FY93	FY94	FY95	FY96	FY97	FY98	FY99	FY00	FY01	FY02	FY03	FY04	FY05	FY06
1 HMMWV	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2 CUCV	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3 LMTV	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4 MTV	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5 MTV(LMTV)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6 TRAILER	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7 TRAILER	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	941
8 LMTV TRLR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	341
9 MTV TRLR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	46
10 TRAILER	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

	18	19	20	21	22	23	24	25	26	27	28	29	30	31	
	FY07	FY08	FY09	FY10	FY11	FY12	FY13	FY14	FY15	FY16	FY17	FY18	FY19	FY20	TOTAL
1 HMMWV	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2 CUCV	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3 LMTV	0	0	536	2,315	6,281	9,940	13,466	18,970	25,237	33,129	39,180	42,063	44,946	47,829	283,892
4 MTV	0	0	5,396	13,920	28,990	43,928	51,126	65,434	86,439	115,604	146,018	167,832	177,078	186,324	1,087,089
5 MTV(LMTV)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6 M101A2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7 M105A2	2,431	3,308	4,408	5,523	7,566	9,413	10,180	11,369	12,782	14,609	14,796	14,983	15,170	15,357	142,838
8 LMTV TRLR	878	1,194	1,589	1,988	2,723	3,385	3,666	4,078	4,581	5,232	5,290	5,347	5,405	5,462	51,149
9 MTV TRLR	120	162	217	272	372	465	503	563	633	726	737	747	758	769	7,088
10 5/4 TRLR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

TABLE C-27. POMCUS QUANTITIES FOR SUSTAINMENT

CALCULATION OF POMCUS VEHICLE QUANTITIES

POMCUS FIELDED QUANTITIES FOR SUSTAINMENT

	FY90	FY91	FY92	FY93	FY94	FY95	FY96	FY97	FY98	FY99	FY00	FY01	FY02	FY03	FY04	FY05	FY06
1 HMMWV	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2 CUCV	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3 LMTV	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4 MTV	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5 MTV(LMTV)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6 TRAILER	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7 TRAILER	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8 LMTV TRLR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9 MTV TRLR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10 TRAILER	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TRUCK TOTAL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

	FY07	FY08	FY09	FY10	FY11	FY12	FY13	FY14	FY15	FY16	FY17	FY18	FY19	FY20	TOTAL
1 HMMWV	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2 CUCV	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3 LMTV	0	0	0	0	0	0	0	0	0	0	1,063	2,237	956	1,147	5,403
4 MTV	0	0	0	0	0	0	0	0	0	0	0	923	6,070	4,930	11,923
5 MTV(LMTV)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6 M101A2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7 M105A2	0	0	0	0	0	0	0	0	0	92	1,436	522	1,026	1,231	4,307
8 LMTV TRLR	(0)	0	0	0	0	0	0	0	0	32	497	181	355	426	1,491
9 MTV TRLR	0	0	0	0	0	0	0	0	0	2	38	14	27	32	113
10 5/4 TRLR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TRUCK TOTAL	0	0	0	0	0	0	0	0	0	0	1,063	3,160	7,026	6,077	17,327

TABLE C-28. RESERVE VEHICLE DOLLARS/VEHICLE BY AGE FOR SUSTAINMENT

CALCULATION OF UNIT O&M COST FOR PONCUS VEHICLES

PONCUS VEHICLES O&M DOLLARS/VEHICLE BY AGE (10% OF ACTIVE)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
	FY90	FY91	FY92	FY93	FY94	FY95	FY96	FY97	FY98	FY99	FY00	FY01	FY02	FY03	FY04	FY05	FY06
1 HMMWV	0.11	0.12	0.13	0.14	0.14	0.15	0.16	0.17	0.18	0.18	0.19	0.20	0.21	0.22	0.00	0.00	0.00
2 CUCV	0.11	0.11	0.12	0.12	0.13	0.14	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3 LMTV	0.22	0.25	0.27	0.30	0.32	0.35	0.37	0.40	0.42	0.44	0.47	0.49	0.52	0.54	0.57	0.59	0.62
4 MTV	0.43	0.46	0.50	0.53	0.57	0.61	0.64	0.68	0.71	0.75	0.78	0.82	0.86	0.89	0.93	0.96	1.00
5 MTV(LMTV)	0.26	0.29	0.32	0.35	0.38	0.41	0.44	0.47	0.50	0.53	0.56	0.59	0.62	0.65	0.67	0.70	0.73
6 TRAILER	0.24	0.24	0.24	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.26	0.26	0.26	0.26	0.26	0.26
7 TRAILER	0.10	0.11	0.11	0.11	0.11	0.11	0.12	0.12	0.12	0.12	0.12	0.13	0.13	0.13	0.13	0.13	0.14
8 LMTV TRLR	0.11	0.11	0.11	0.11	0.12	0.12	0.12	0.12	0.12	0.12	0.13	0.13	0.13	0.13	0.13	0.13	0.14
9 MTV TRLR	0.19	0.20	0.20	0.21	0.21	0.22	0.22	0.22	0.23	0.23	0.24	0.24	0.25	0.25	0.26	0.26	0.26
10 TRAILER	0.10	0.10	0.10	0.10	0.10	0.11	0.11	0.11	0.11	0.12	0.12	0.12	0.12	0.12	0.13	0.13	0.13

	18	19	20	21	22	23	24	25	26	27	28	29	30	31	
	FY07	FY08	FY09	FY10	FY11	FY12	FY13	FY14	FY15	FY16	FY17	FY18	FY19	FY20	TOTAL
1 HMMWV	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2
2 CUCV	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1
3 LMTV	0.64	0.67	0.69	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9
4 MTV	1.04	1.07	1.11	1.14	1.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	19
5 MTV(LMTV)	0.76	0.79	0.82	0.86	0.88	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	13
6 M101A2	0.26	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.28	0.28	0.28	0.28	0.28	0.00	8
7 M105A2	0.14	0.14	0.14	0.14	0.15	0.15	0.15	0.15	0.15	0.16	0.16	0.16	0.16	0.00	4
8 LMTV TRLR	0.14	0.14	0.14	0.14	0.15	0.15	0.15	0.15	0.15	0.15	0.16	0.16	0.16	0.00	4
9 MTV TRLR	0.27	0.27	0.28	0.28	0.29	0.29	0.30	0.30	0.30	0.31	0.31	0.32	0.32	0.00	8
10 5/4 TRLR	0.13	0.14	0.14	0.14	0.14	0.14	0.15	0.15	0.15	0.15	0.16	0.16	0.16	0.00	4

TABLE C-29. RESERVE VEHICLE COST PER YEAR FOR SUSTAINMENT

CALCULATION OF TOTAL O&M COST FOR PONCUS VEHICLES

PONCUS VEHICLES TOTAL O&M DOLLARS/YEAR

	1 FY90	2 FY91	3 FY92	4 FY93	5 FY94	6 FY95	7 FY96	8 FY97	9 FY98	10 FY99	11 FY00	12 FY01	13 FY02	14 FY03	15 FY04	16 FY05	17 FY06
1 HMMWV	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2 CUCV	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3 LMTV	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4 MTV	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5 MTV(LMTV)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6 TRAILER	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7 TRAILER	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8 LMTV TRLR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9 MTV TRLR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10 TRAILER	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

	18 FY07	19 FY08	20 FY09	21 FY10	22 FY11	23 FY12	24 FY13	25 FY14	26 FY15	27 FY16	28 FY17	29 FY18	30 FY19	31 FY20	TOTAL
1 HMMWV	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2 CUCV	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3 LMTV	0	0	0	0	0	0	0	0	0	0	238	764	1,058	1,419	3,479
4 MTV	0	0	0	0	0	0	0	0	0	0	0	394	3,018	5,372	8,784
5 MTV(LMTV)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5 M101A2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7 M105A2	0	0	0	0	0	0	0	0	0	10	158	215	326	459	1,158
8 LMTV TRLR	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	3	57	78	117	165	421
9 MTV TRLR	0	0	0	0	0	0	0	0	0	0	8	11	16	23	57
10 5/4 TRLR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

TABLE C-30. TOTAL SUSTAINMENT COST FOR ALL VEHICLES

CALCULATION BASED ON FIELDED QUANTITIES TIMES O&M DOLLARS/YEAR
SUSTAINMENT DOLLARS IN FY 90 CONSTANT$(000'S)

	FY90	FY91	FY92	FY93	FY94	FY95	FY96	FY97	FY98	FY99	FY00	FY01	FY02	FY03	FY04	FY05	FY06
1 HMMWV	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2 CUCV	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3 LMTV	0	0	0	1,642	5,110	8,939	13,130	18,111	23,501	25,584	27,666	29,749	31,831	35,134	39,980	45,049	50,826
4 MTV	0	0	3,572	12,468	26,674	41,997	61,700	82,704	98,313	105,110	111,907	118,704	125,501	138,013	156,710	176,365	198,881
5 MTV(LMTV)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6 TRAILER	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7 TRAILER	0	0	278	1,200	2,743	4,316	6,175	8,125	9,583	9,760	9,937	10,114	10,292	11,105	12,570	14,058	15,778
8 LMTV TRLR	0	0	100	432	989	1,554	2,220	2,919	3,437	3,491	3,545	3,600	3,654	3,939	4,458	4,984	5,592
9 MTV TRLR	0	0	14	58	133	212	304	400	475	485	495	505	516	557	630	704	792
10 TRAILER	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

	FY07	FY08	FY09	FY10	FY11	FY12	FY13	FY14	FY15	FY16	FY17	FY18	FY19	FY20	TOTAL
1 HMMWV	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2 CUCV	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3 LMTV	56,931	62,083	67,725	73,297	81,058	88,511	90,577	89,178	88,180	88,446	85,374	79,014	83,903	83,859	1,479,450
4 MTV	222,515	241,556	262,238	283,099	310,505	337,780	357,314	373,795	382,403	385,336	387,411	372,859	345,818	336,392	6,057,632
5 MTV(LMTV)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6 M101A2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7 M106A2	17,517	18,643	19,993	21,357	23,649	25,745	26,762	28,199	29,862	31,948	32,533	33,026	33,573	34,143	502,986
8 LMTV TRLR	6,206	6,598	7,070	7,546	8,357	9,095	9,443	9,942	10,521	11,253	11,440	11,595	11,768	11,950	177,099
9 MTV TRLR	880	937	1,006	1,075	1,190	1,297	1,360	1,424	1,508	1,616	1,649	1,677	1,708	1,739	25,337
10 5/4 TRLR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

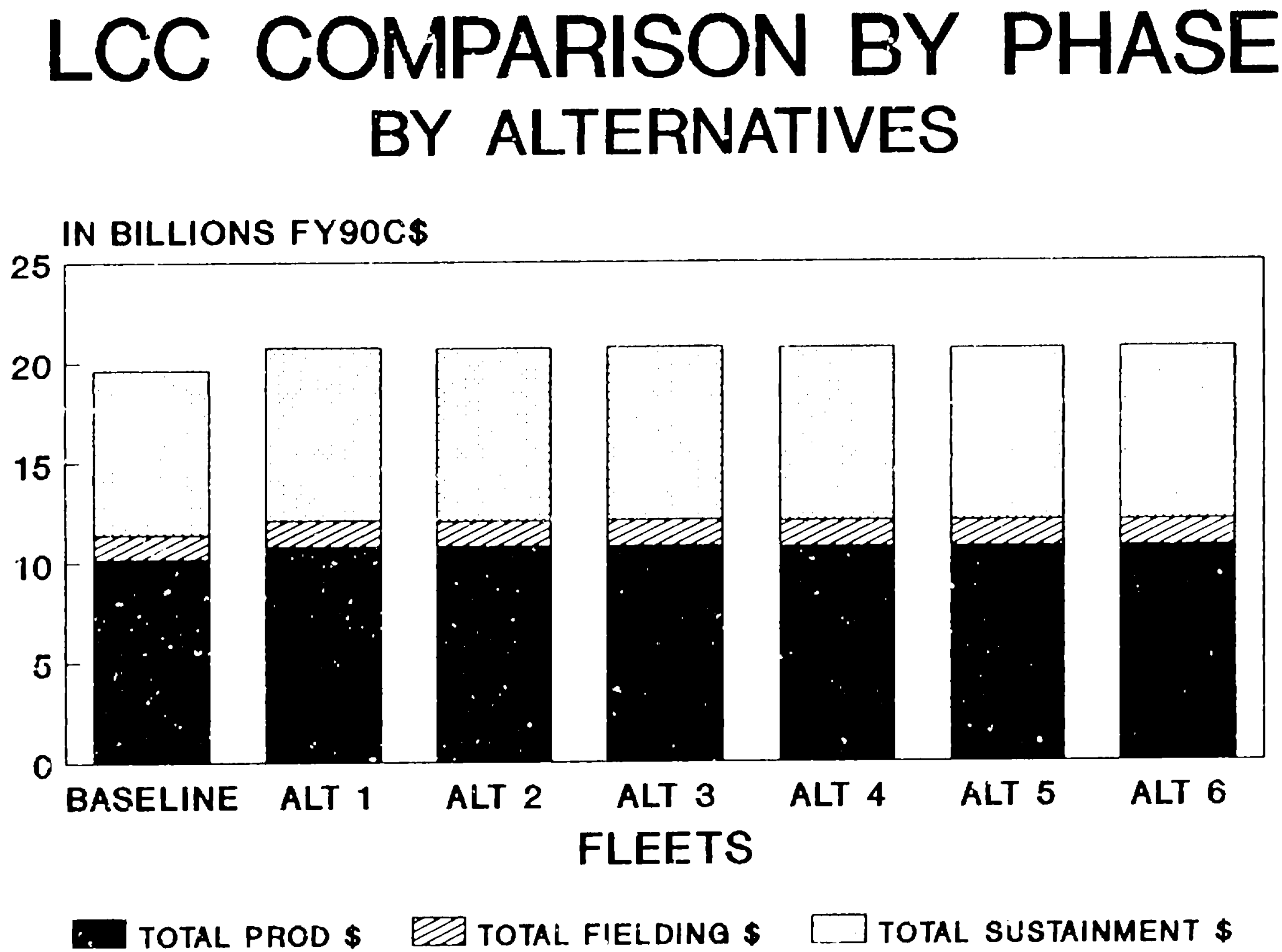


FIGURE C-2. LIFE CYCLE COST (LCC) BY COST PHASE FOR THE BASELINE AND EACH ALTERNATIVE

TABLE C-31. CUMULATIVE LIFE CYCLE COST FOR THE BASELINE

CUM LCC BY PHASE
BASELINE (97,880)

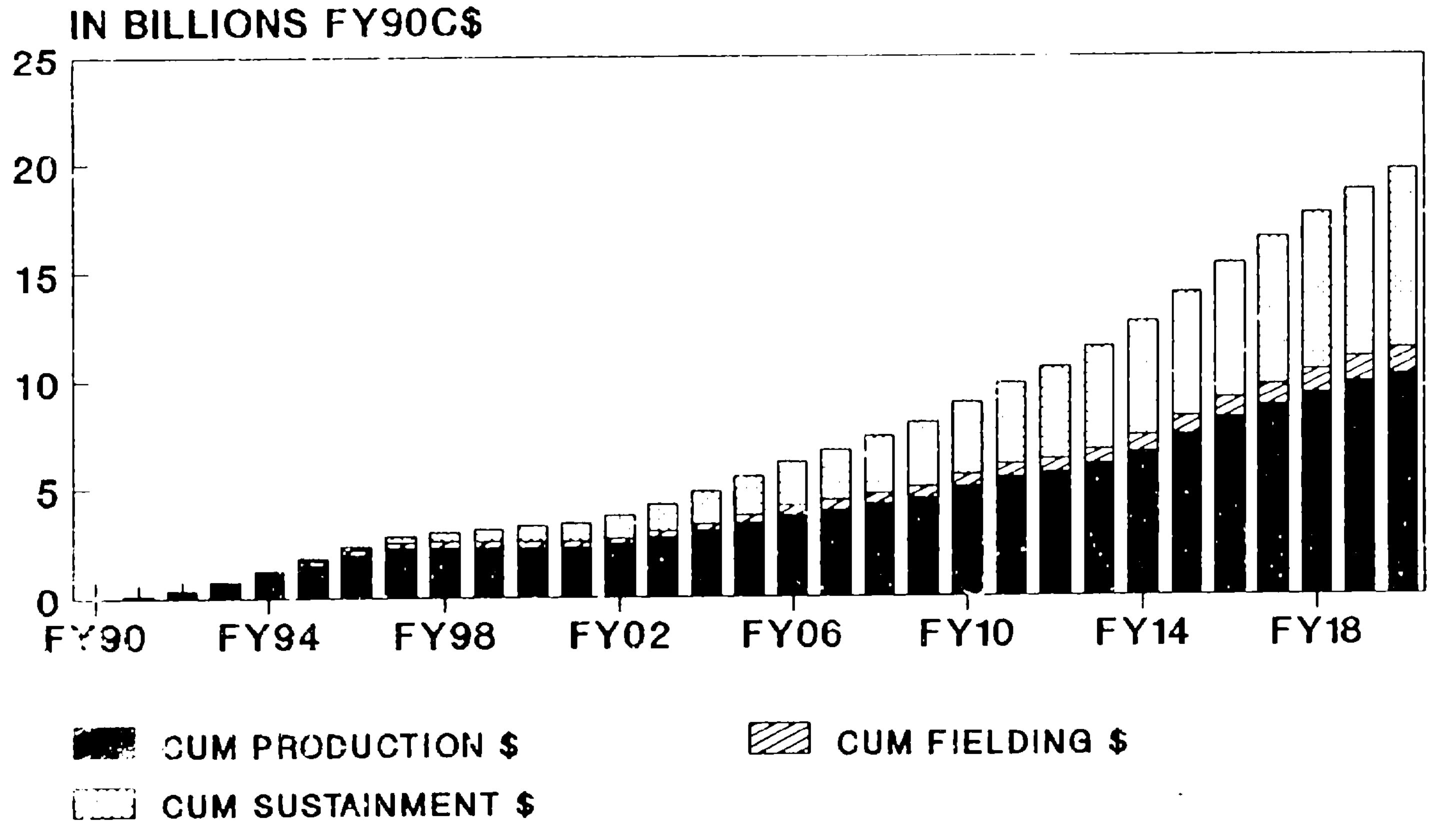


TABLE C-32. CUMULATIVE LIFE CYCLE COST FOR ALTERNATIVE 1

CUM LCC BY PHASE
ALT 1 (97,880)

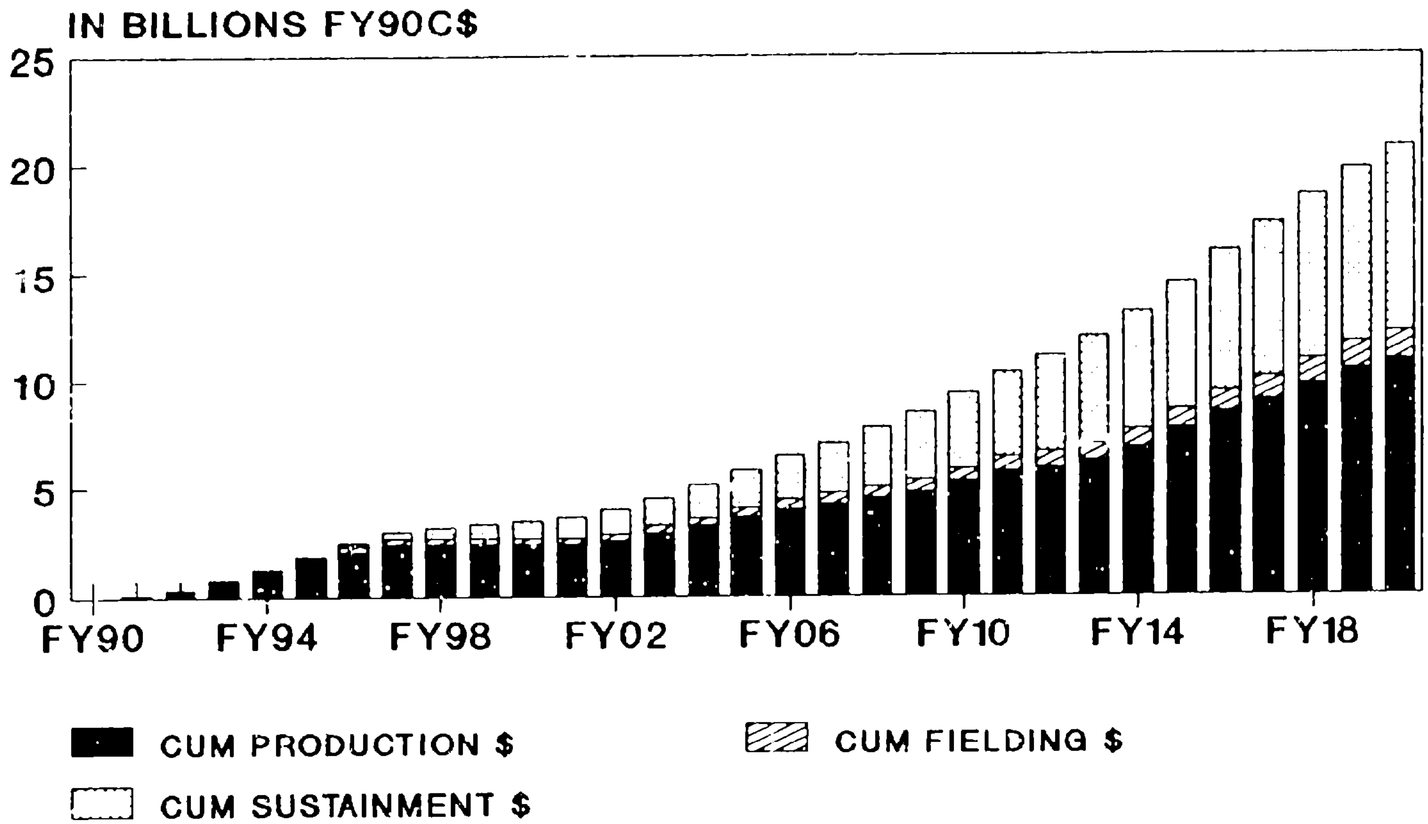


TABLE C-33. CUMULATIVE LIFE CYCLE COST FOR ALTERNATIVE 2

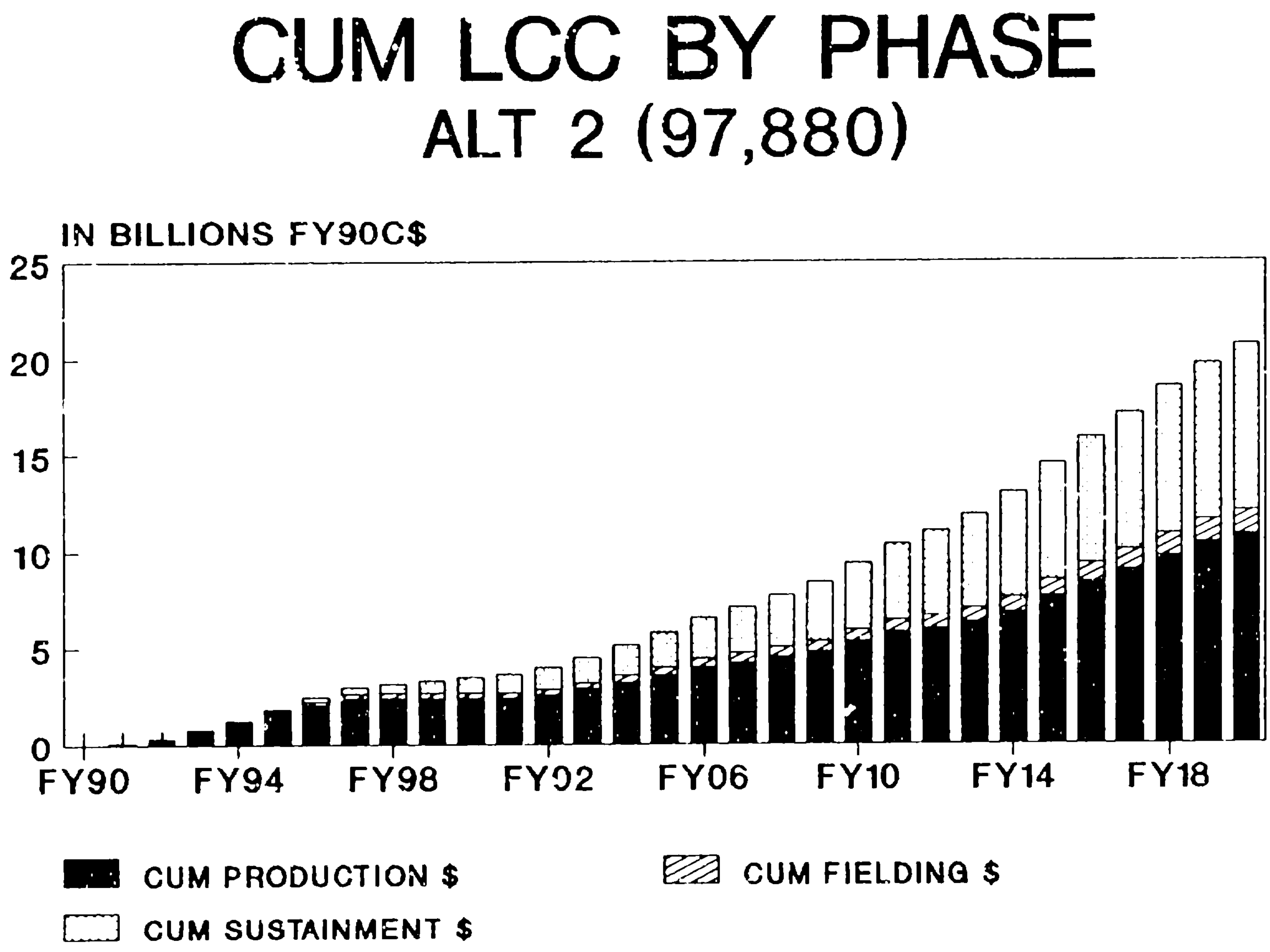


TABLE C-34. CUMULATIVE LIFE CYCLE COST FOR ALTERNATIVE 3

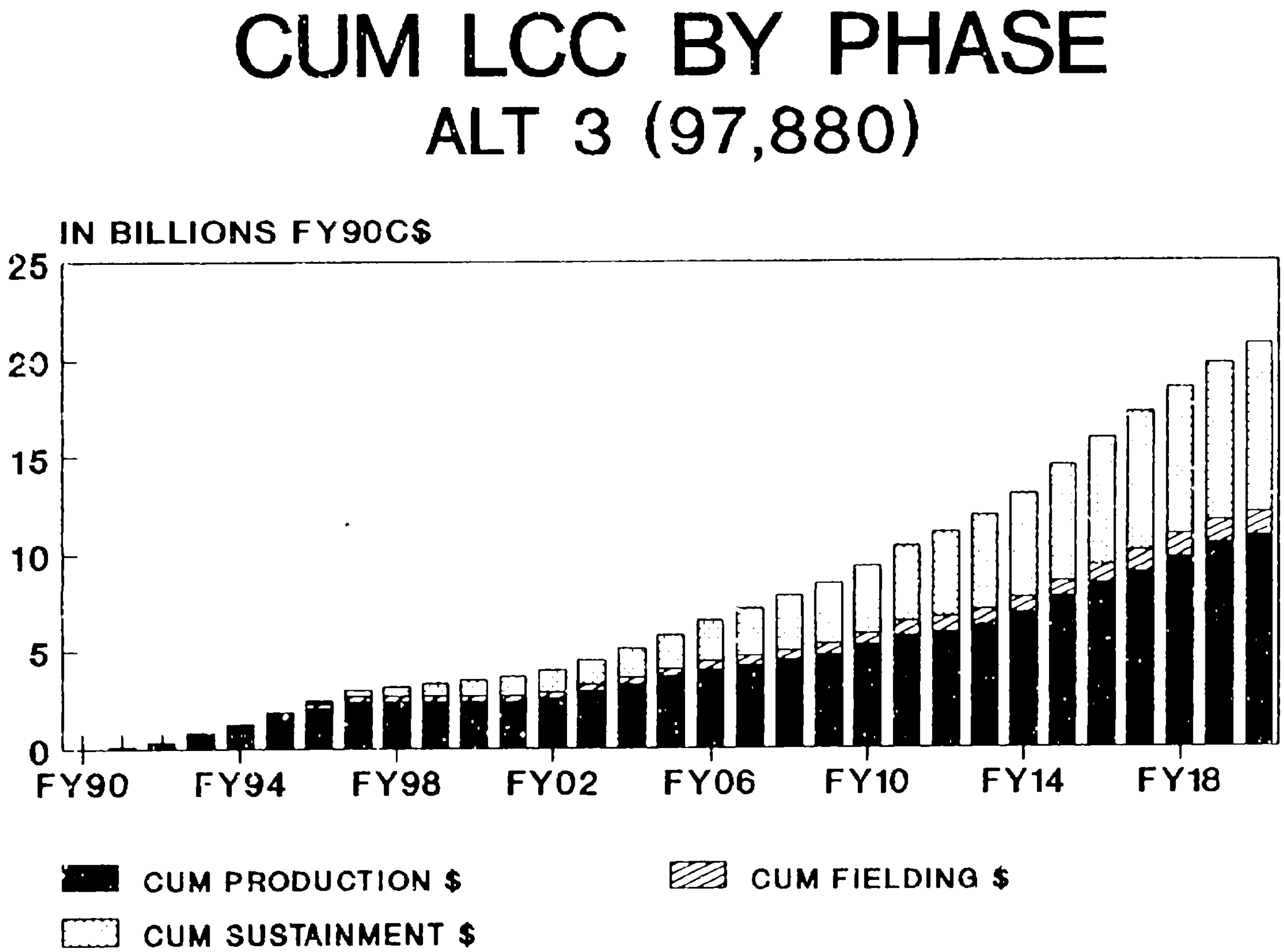


TABLE C-35. CUMULATIVE LIFE CYCLE COST FOR ALTERNATIVE 4

CUM LCC BY PHASE

ALT 4 (97,880)

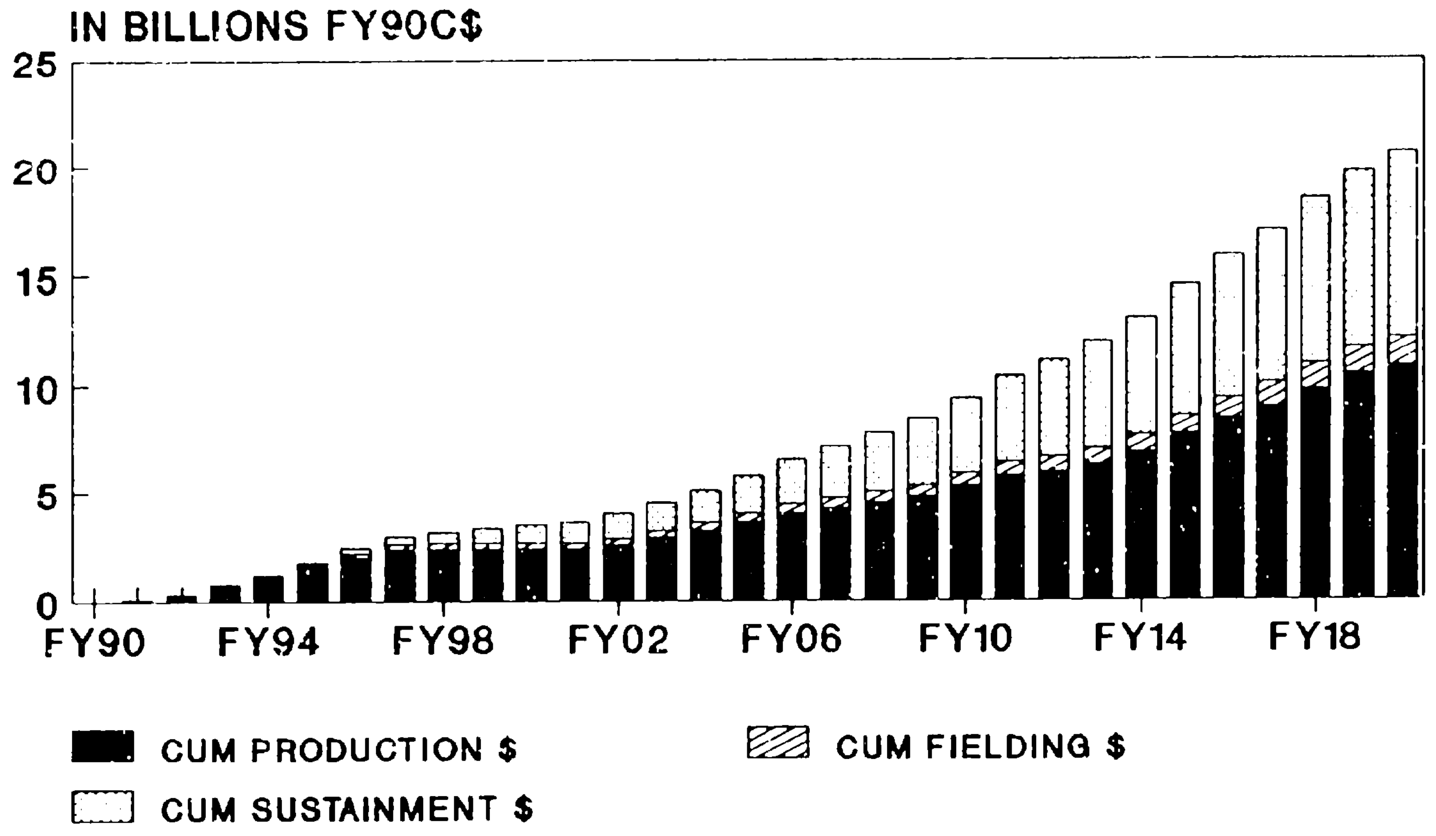


TABLE C-36. CUMULATIVE LIFE CYCLE COST FOR ALTERNATIVE 5

CUM LCC BY PHASE
ALT 5 (97,880)

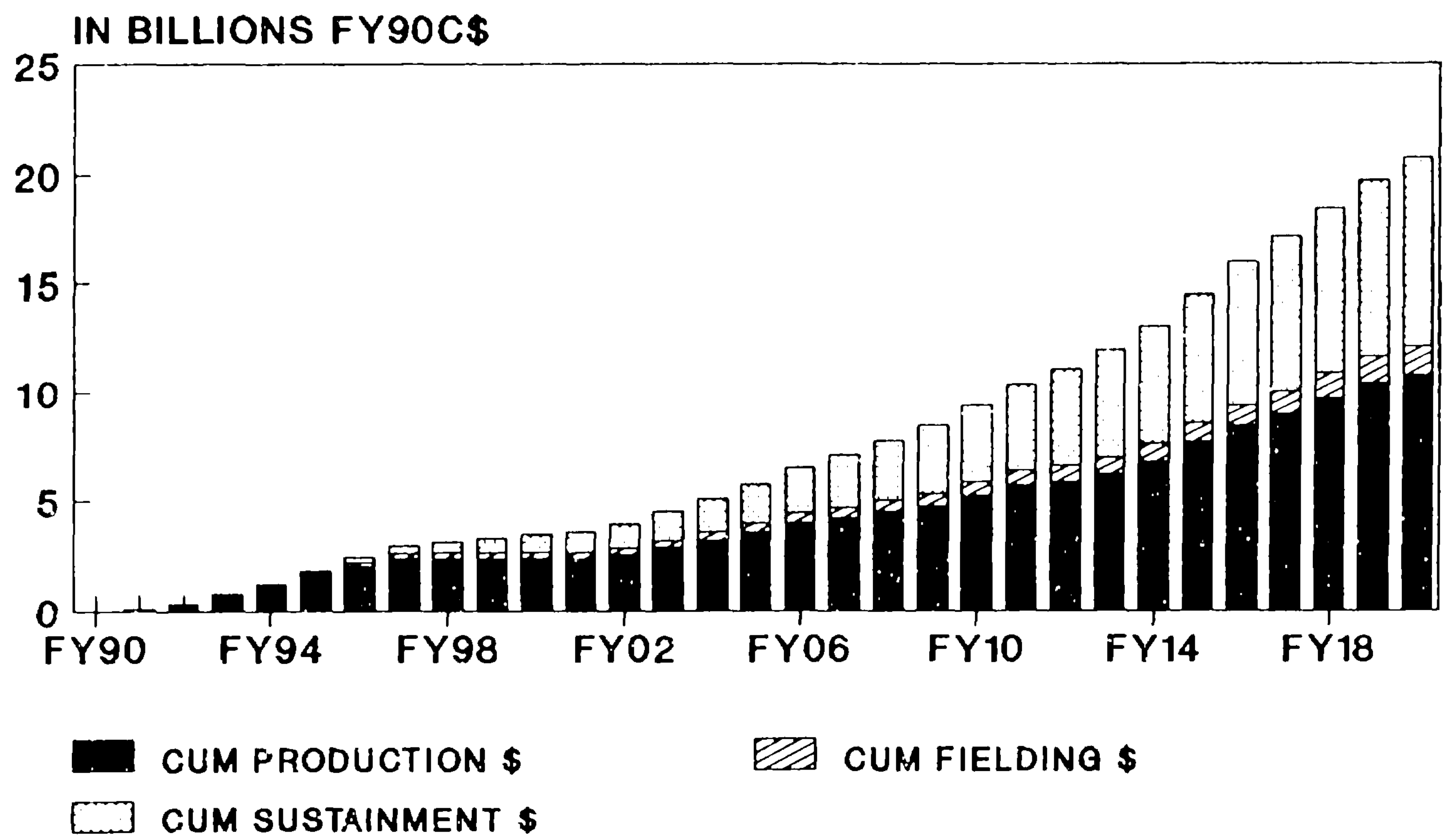
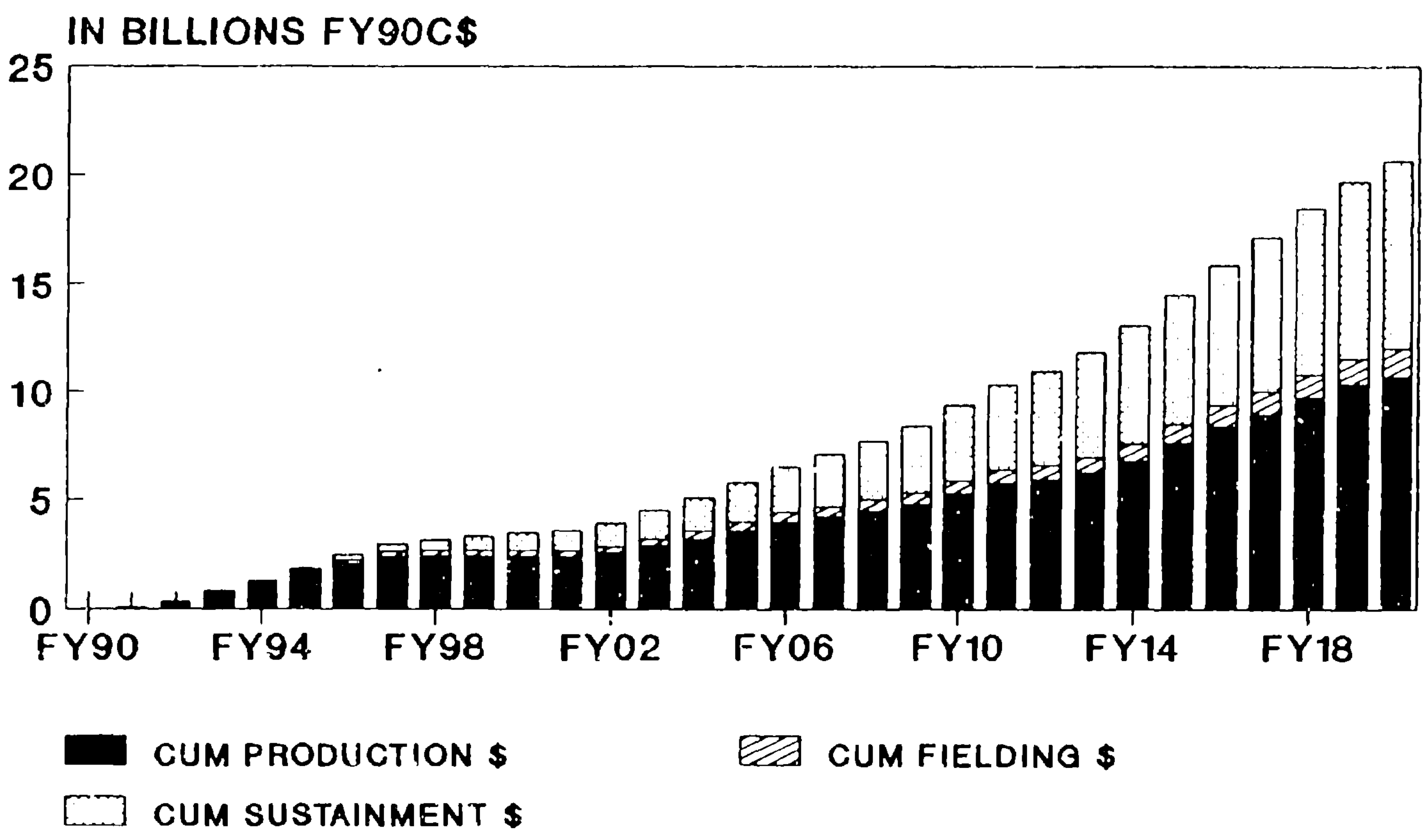


TABLE C-37. CUMULATIVE LIFE CYCLE COST FOR ALTERNATIVE 6

CUM LCC BY PHASE

ALT 6 (97,880)



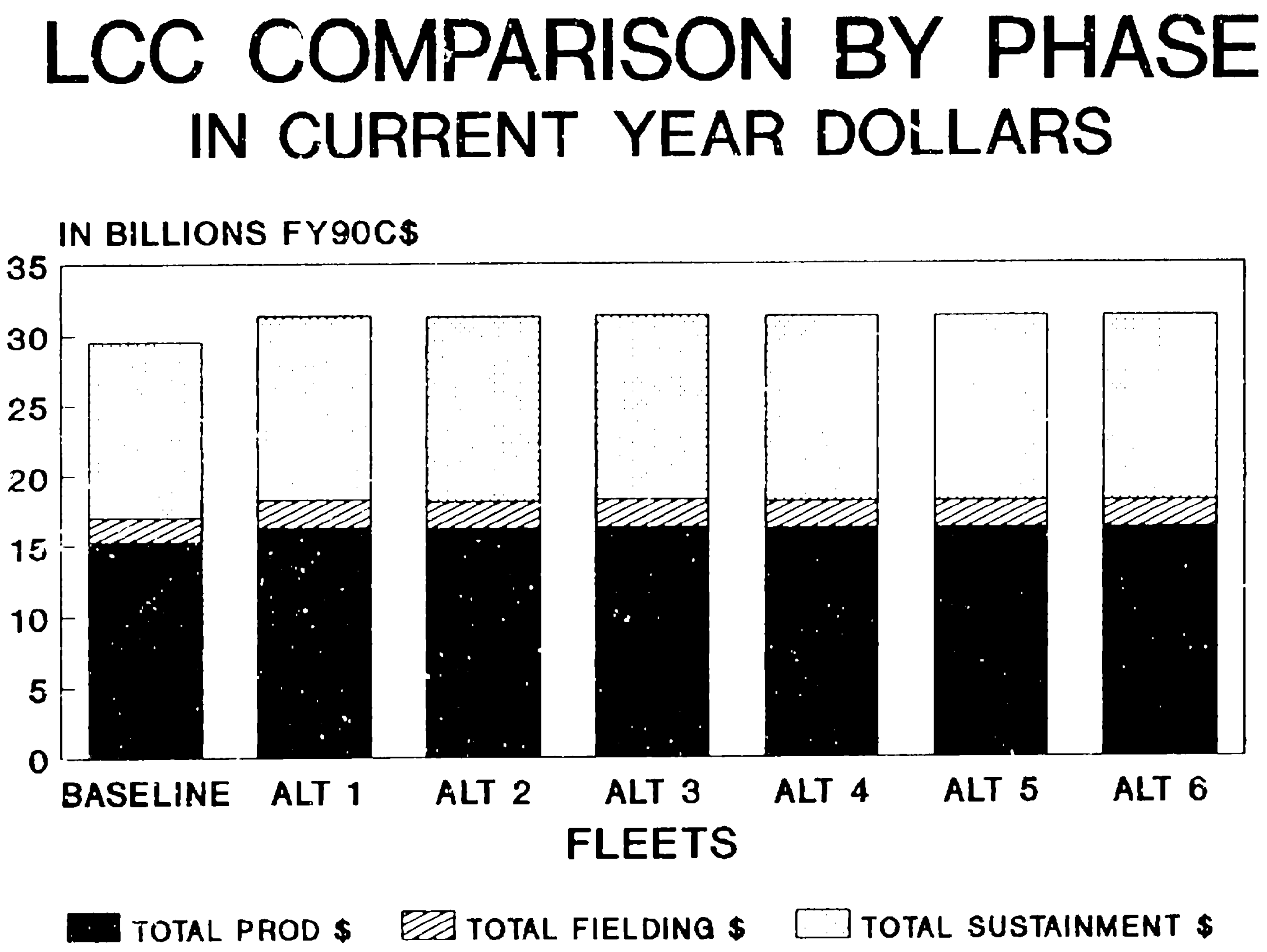


FIGURE C-3. LIFE CYCLE COST (LCC) BY COST PHASE FOR THE BASELINE ALTERNATIVES

TABLE C-38. CUMULATIVE LIFE CYCLE COST FOR THE BASELINE IN CURRENT DOLLARS

INFLATED CUM LCC BY PHASE
BASELINE (97,880)

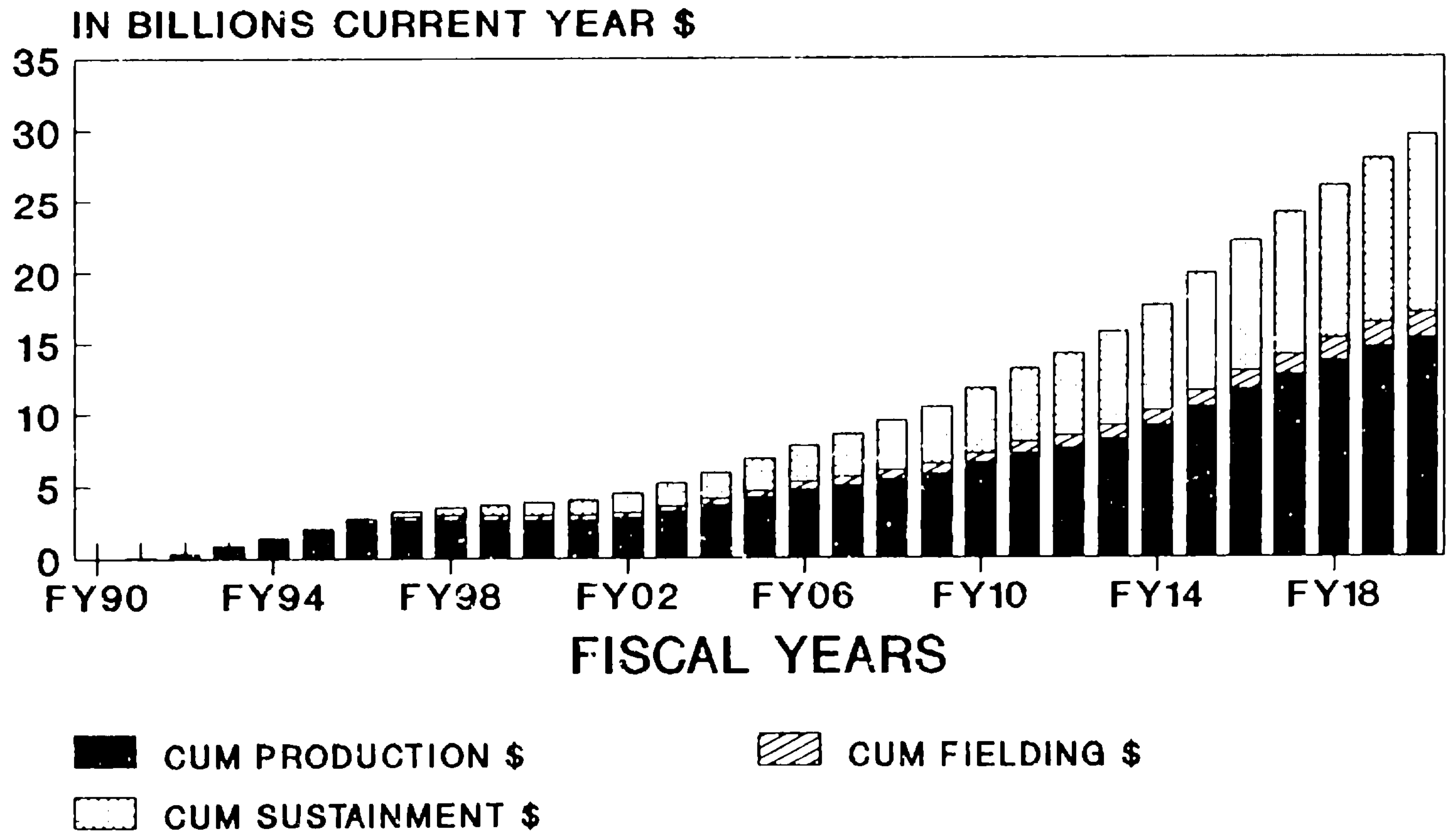


TABLE C-39. CUMULATIVE LIFE CYCLE COST FOR ALTERNATIVE 1 IN CURRENT DOLLARS

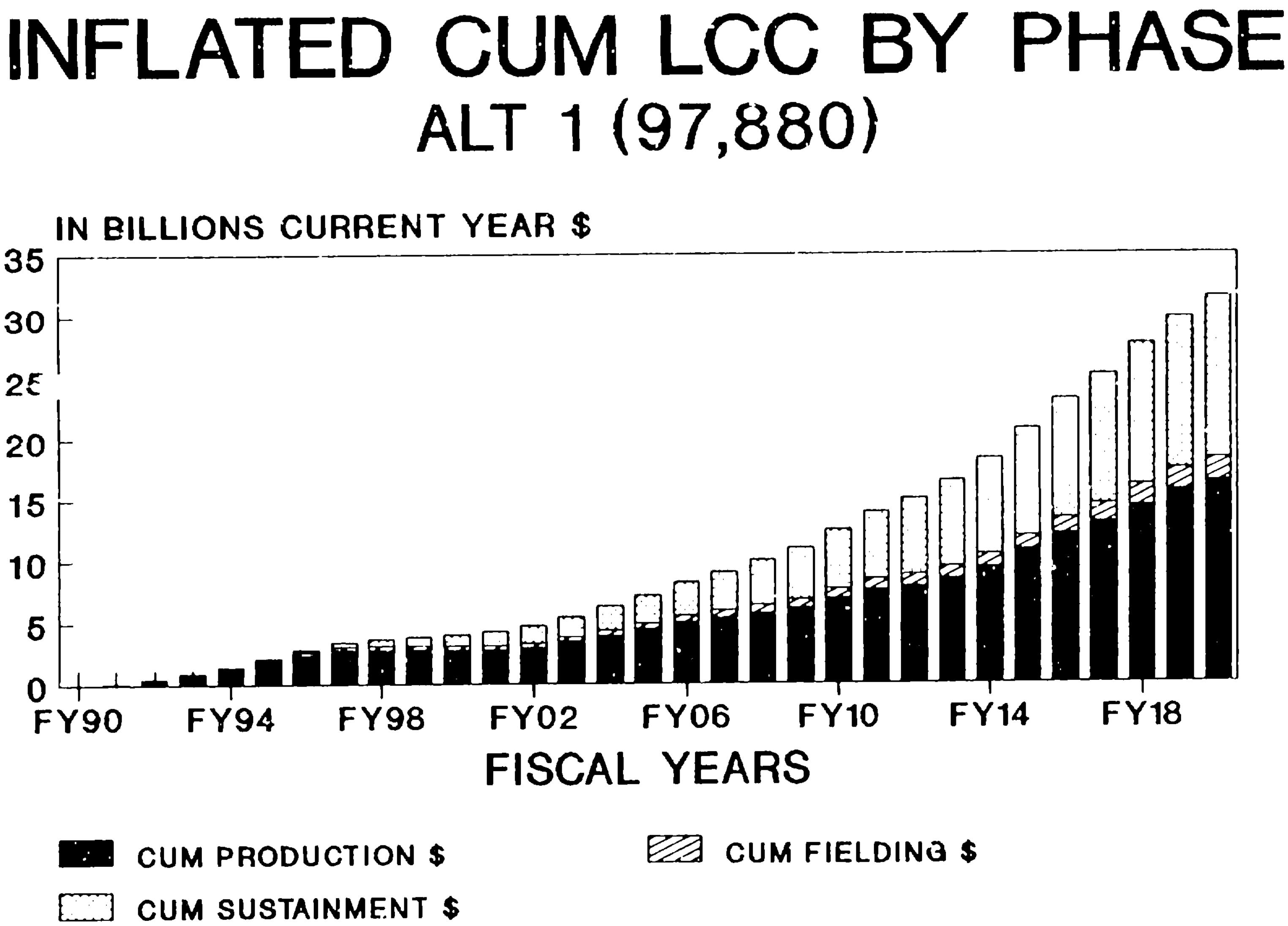


TABLE C-40. CUMULATIVE LIFE CYCLE COST FOR ALTERNATIVE 2 IN CURRENT DOLLARS

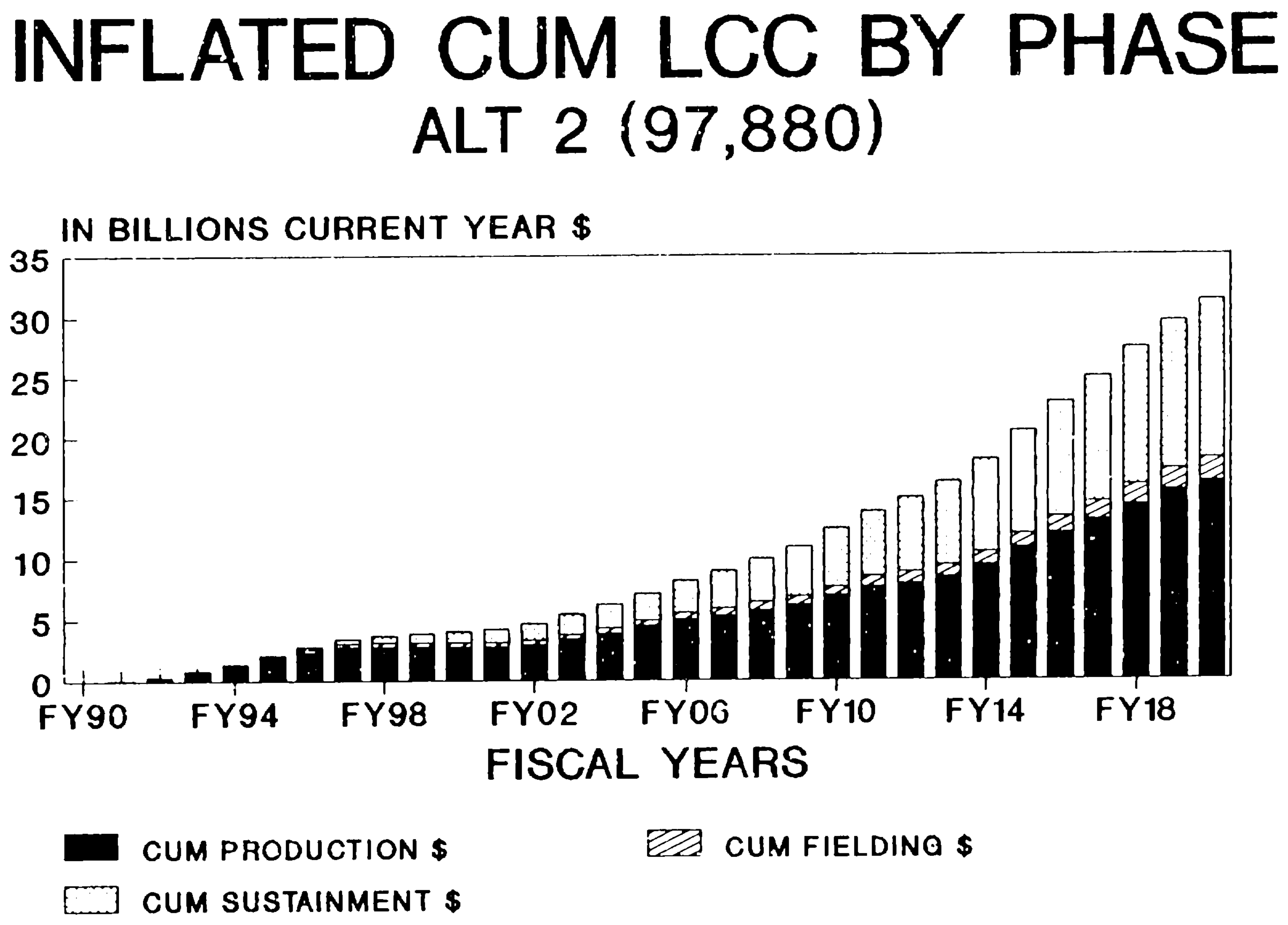


TABLE C-41. CUMULATIVE LIFE CYCLE COST FOR ALTERNATIVE 3 IN CURRENT DOLLARS

INFLATED CUM LCC BY PHASE

ALT 3 (97,880)

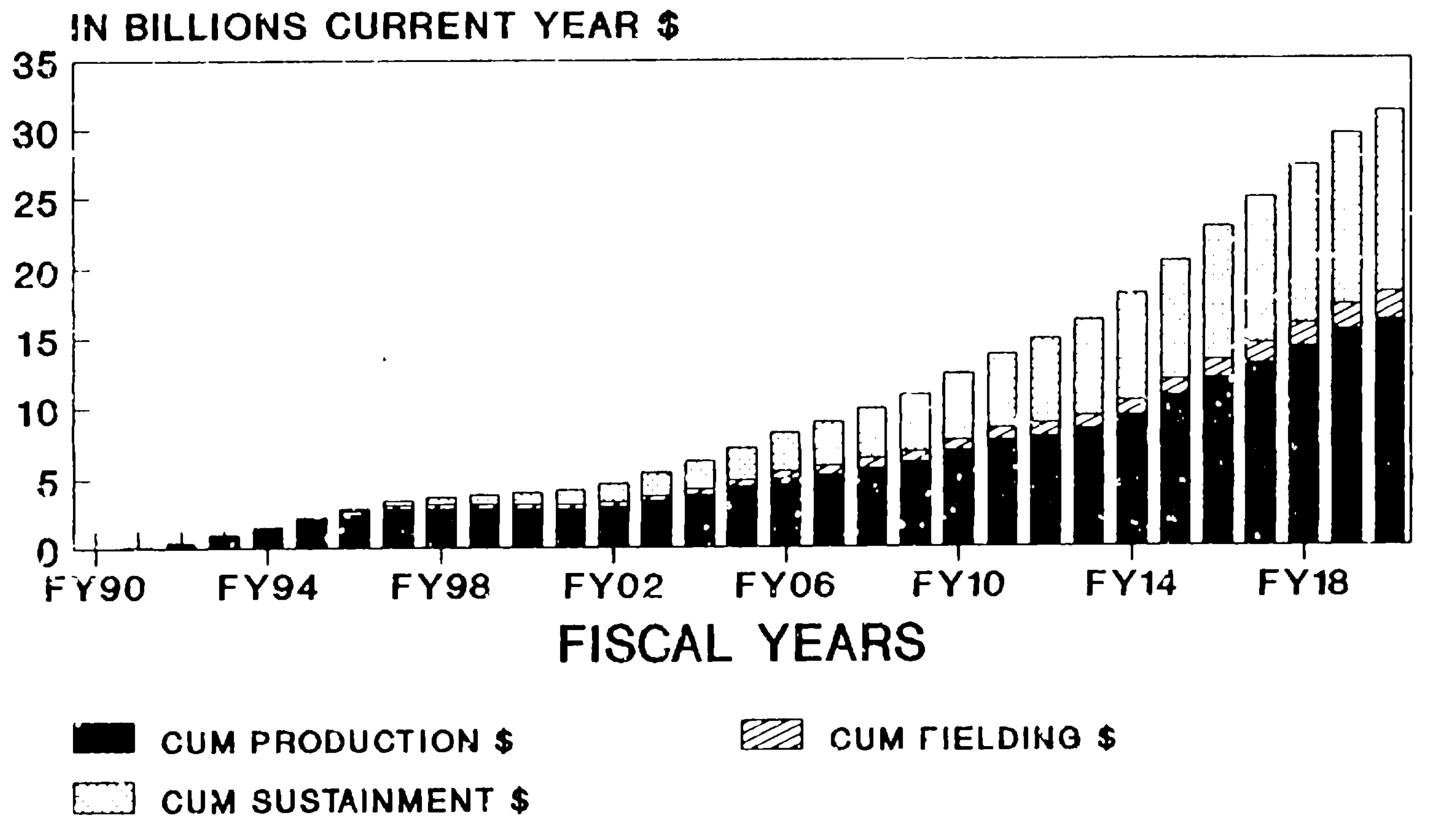


TABLE C-42. CUMULATIVE LIFE CYCLE COST FOR ALTERNATIVE 4 IN CURRENT DOLLARS

INFLATED CUM LCC BY PHASE
ALT 4 (97,880)

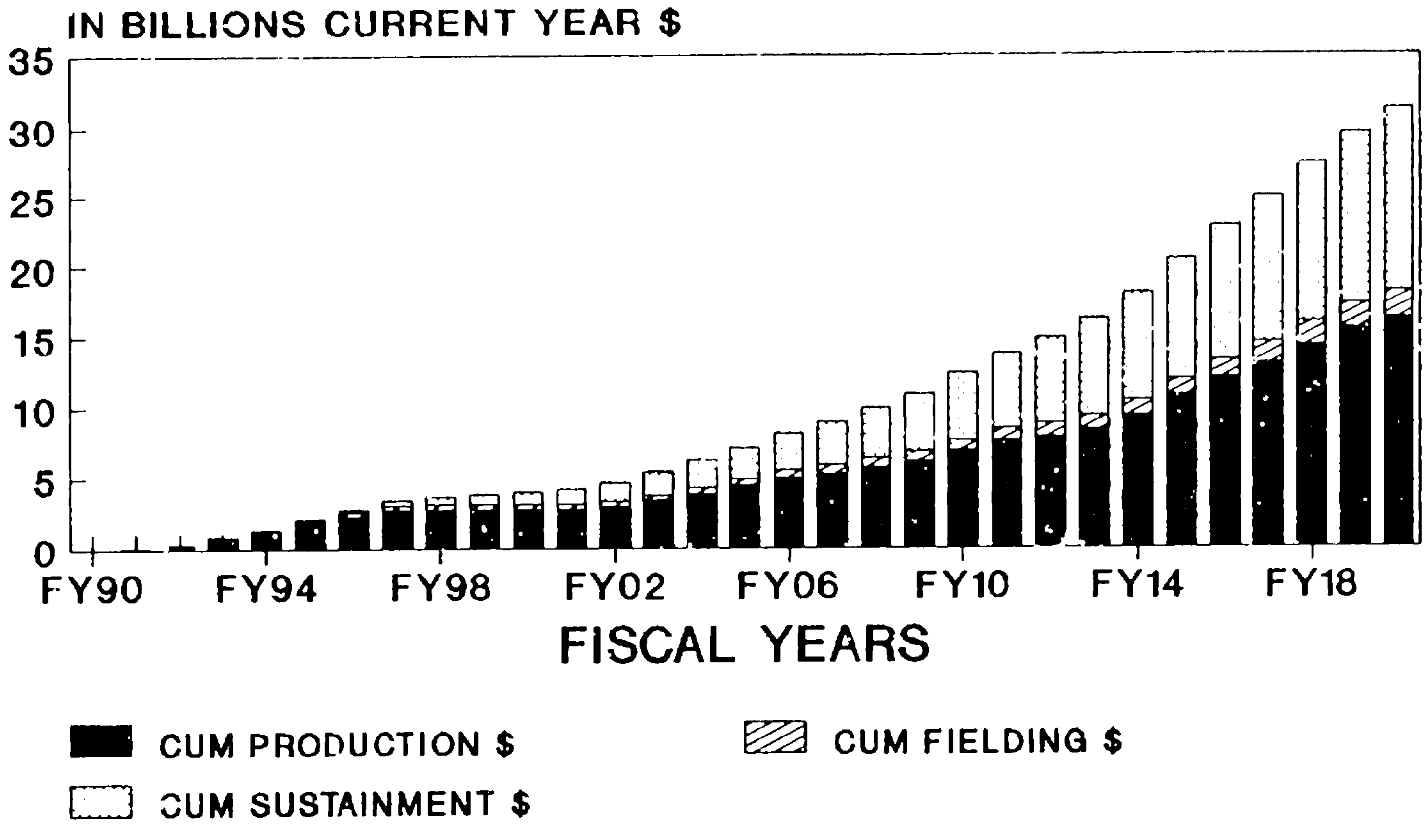


TABLE C-43. CUMULATIVE LIFE CYCLE COST FOR ALTERNATIVE 5 IN CURRENT DOLLARS

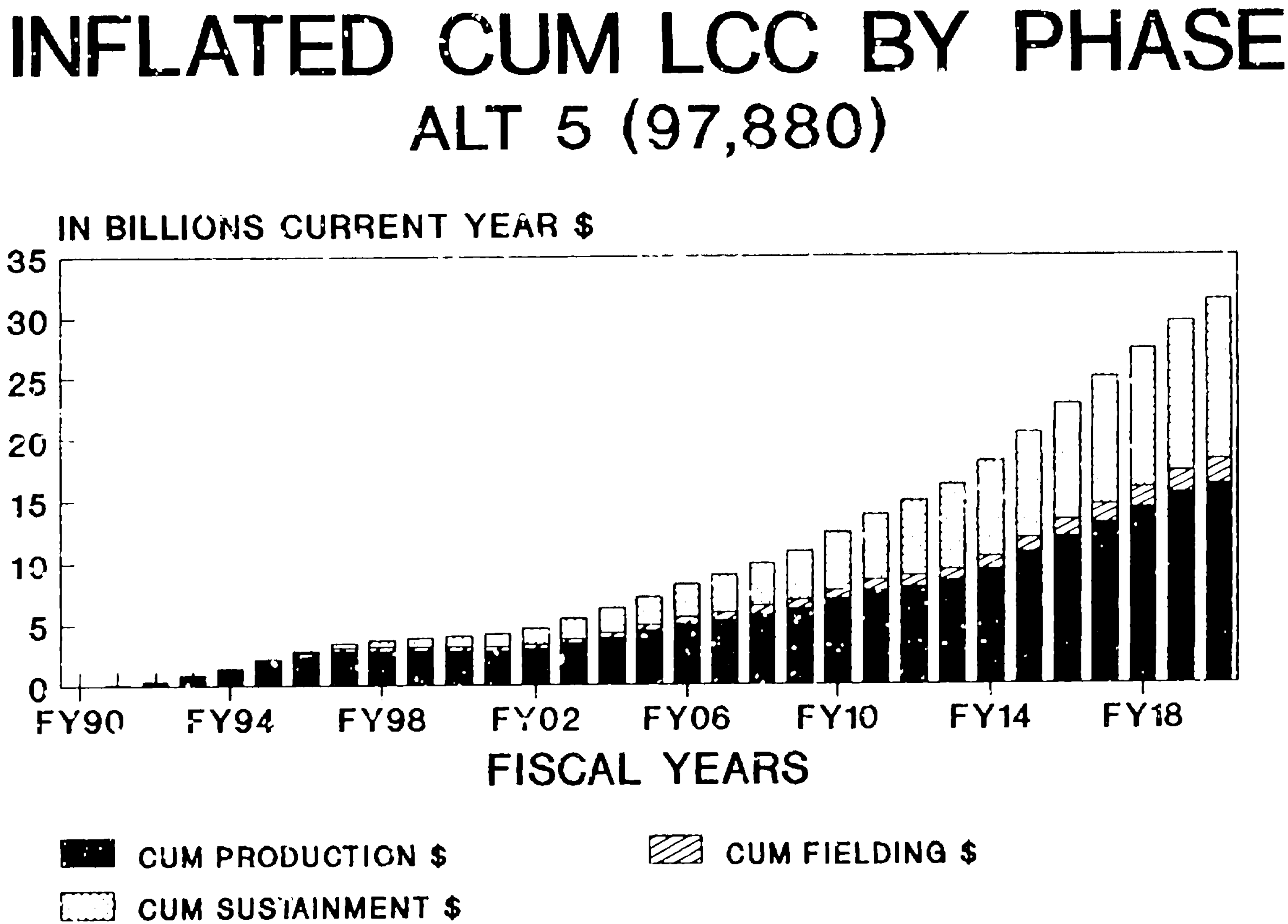
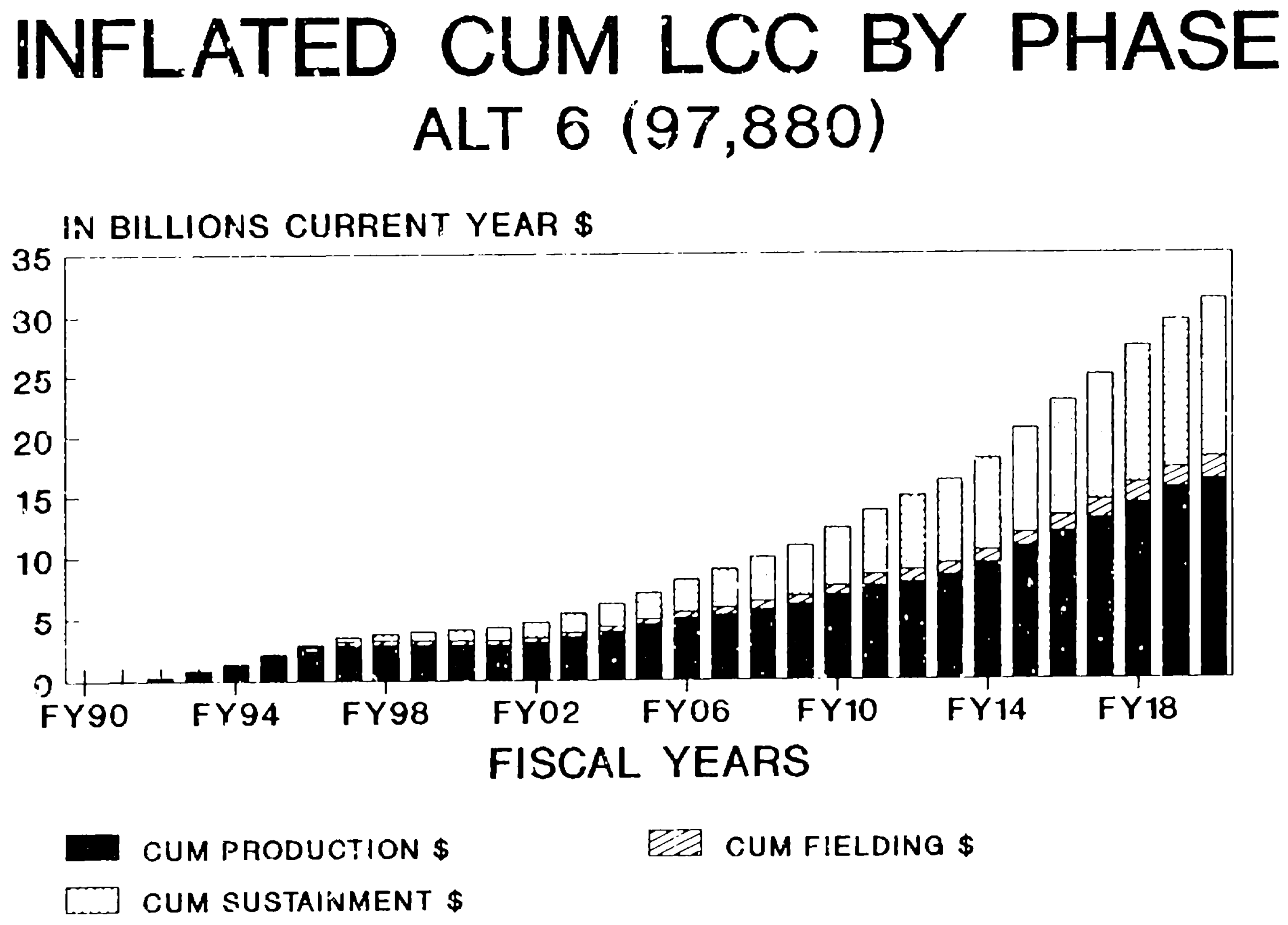


TABLE C-44. CUMULATIVE LIFE CYCLE COST FOR ALTERNATIVE 6 IN CURRENT DOLLARS



APPENDIX I
TO
ANNEX C

A summary of the significant meetings involving the cost analysis portion of this project is presented below. This summary is intended to provide a chronology of events regarding the cost analysis methodology developed for this study.

1. The first Study Advisory Group meeting was held on October 3, 1988. Other activities accomplished during October were meetings with Government personnel from the Program Executive Office for Combat Service Support and TACOM Cost Analysis Division. Phone conversations were conducted with AMSAA personnel regarding the maintenance expenditure limit model which was used to develop economic life and maintenance policies for the TWV fleet.

2. During November, technical discussions were held with Government personnel from the Program Executive Office (PEO) for Combat Service Support, TACOM Cost Analysis, US Army Cost and Economic Analysis Center, AMSAA, and the COTR. The cost model was developed with an emphasis on the FMTV BCE as the primary source document for annual quantities and cost information. At this time it was anticipated to use TACOM's Fielding and Sustainment Cost Accounting Model to generate sustainment costs. Also at this time, the model was structured to include all trucks within the LMTV and MTV family.

3. The SAG II meeting was held on December 6, 1988. A post SAG II meeting was held at the Pentagon to address issues raised during SAG II by Col. Mclendon.

4. During January, Mr. Currie visited with representatives from TACOM Cost Analysis Division. Cost analysis methods were refined and reviewed. At this point in the cost model's development, the structure was tied to the FMTV BCE and sustainment cost data was provided in the form of annual Operating and Sustainment (O&S) costs per family of trucks. It was subsequently determined that a more accurate method of estimating sustainment costs would be to follow the methodology established in the truck modernization plan. That is, direct operating costs would be modeled as a linear function of vehicle age and annual mileage. This approach made use of cost data collected for the Army under the Sample Data Collection (SDC) effort and duplicated the estimating equations developed for each family of vehicles. The equations were developed by Mr. Bob Daigle from TACOM's Fleet Planning Office. Mr. Currie and Mr. Daigle met and discussed the use and application of these equations with the automated cost model Mr. Currie was developing.

5. On Thursday, 2 February 1989, Mr. Currie and Mr. Hunt briefed Col. Mclendon (Deputy Director, USACEAC), Mr. Williams (Vehicles, Electronics, and Ammunition ICE Division Chief), Mr. Scott (USACEAC-VE analyst). The focus of the meeting was a discussion of cost analysis methodology and issues. CEAC overall guidance suggested an extended buy approach tied to the FMTV BCE dollar constraint.

6. On Thursday, 16 February 1989, a meeting was held with Dr. Hinkle and representatives from USACEAC to discuss the spreading methodology in the cost analysis. It was pointed out that the SAIC cost model was being developed using a dollar constraint tied to the FMTV BCE. This entailed a longer procurement timeframe than the one established in the FMTV COEA. An emerging results pre-SAG meeting was held for interested government personnel on Monday, 27 February 1989 and SAG III was conducted on Tuesday, 28 February 1989. There appeared to be a consensus that the analysis was progressing well. A Government representative from DAMO-FD brought up the idea of redesigning the cost model to more adequately reflect the unit costs and annual quantities within the approved Truck modernization plan.

7. On March 9, 1989 a meeting was held at the Pentagon, chaired by Col. Mclendon (USACEAC) to discuss and finalize the costing methodology to be used in the study. This meeting was attended by the COTR, Dr. Hinkle, SAIC representatives (Mr. Hannon, Mr. Hunt and Mr. Currie), and representatives from DAMO-FD. It was agreed that the cost methodology be restructured away from the FMTV BCE and be redefined to follow the costs and quantities consistent with the Army's approved Truck Modernization Plan. Mr. Currie subsequently visited with Government representatives from TACOM to collect data for the logistics analysis assessment and unit costs for vehicles within the truck modernization plan. A meeting was held on the 20th with Dr. Hinkle to define the number and nature of alternatives to be analyzed as well as an initial definition of the sensitivities of interest.

8. Mr. Hunt (SAIC Senior Cost Analyst) and Mr. Hannon (Principal Investigator) met with TACOM personnel on 10 April and key members of the Combat Support PEO were briefed. The cost analysis was completed during the month of April and the Draft Final Report was submitted on 28 April 1989.

ANNEX D

LIST OF ACRONYMS

AALPS	Automated Aircraft Load Planning System
AAO	Authorized Acquisition Objective
ACL	Aircraft Load
AIT	Advanced Individual Training
AMM	Army Mobility Model
BOIP	Basis of Issue Plan
CAC	Combined Arms Center
CER	Cost Estimating Relationships
CUCV	Commercial Utility/Cargo Vehicle
DA	Department of the Army
FAS	Force Accounting System
FDSA	Force Development Support Agency
FMTV	Family of Medium Tactical Vehicles
HMMWV	High Mobility Multipurpose Wheeled Vehicle
IIQ	Initial Issue Quantity
IOC	Initial Operational Capability
LCC	Life Cycle Cost
LIN	Line Item Number
LMTV	Light Medium Tactical Vehicle
LOGSACS	Logistics Structure and Accounting System
LWB	Low Wheel Base
MHE	Material Handling Equipment
MOS	Military Occupational Specialty
MSC	Major Subordinate Command
MTOE	Modified Table of Organization and Equipment
MTV	Medium Tactical Vehicle
NSN	National Stock Number
ODCSOPS	Office, Deputy Chief of Staff, Operations
PEO	Program Executive Office
PLL	Prescribed Load List
POL	Petroleum, Oil, and Lubricants
POMCUS	Prepositioned Materiel Configured to Unit Sets

SAG	Study Advisory Group
SAIC	Science Applications International Corporation
SDC	Sample Data Collection
SLEP	Service Life Extension Program
SRC	Standard Reference Code
TACOM	US Army Tank and Automotive Command
TDA	Table of Distribution and Allowances
TMDE	Test Maintenance Diagnostic Equipment
TOE	Table of Organization and Equipment
TRADOC	US Army Training and Doctrine Command
TWVRMO	Tactical Wheeled Vehicle Requirements Management Office (TRADOC)
UPC	Unit Procurement Cost
USACEAC	US Army Cost and Economic Analysis Center
UTDP	Updated Technical Data Package
WES	Waterways Experiment Station
WTB	Warranty Technical Bulletin